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THE PRACTICAL TEACHER

Mr. AUGUSTINE BIRRELL, K.C.

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OF THE

JANUARY NUMBER

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PRESENTATION SUPPLEMENT—MAP OF THE INDIAN EMPIRE, TO ILLUSTRATE THE ROYAL TOUR.

·VOL· XXVI No 7

EDITORIAL, PUBLISHING AND ADVERTISING OFFICES OF "THE PRACTICAL TEACHER"
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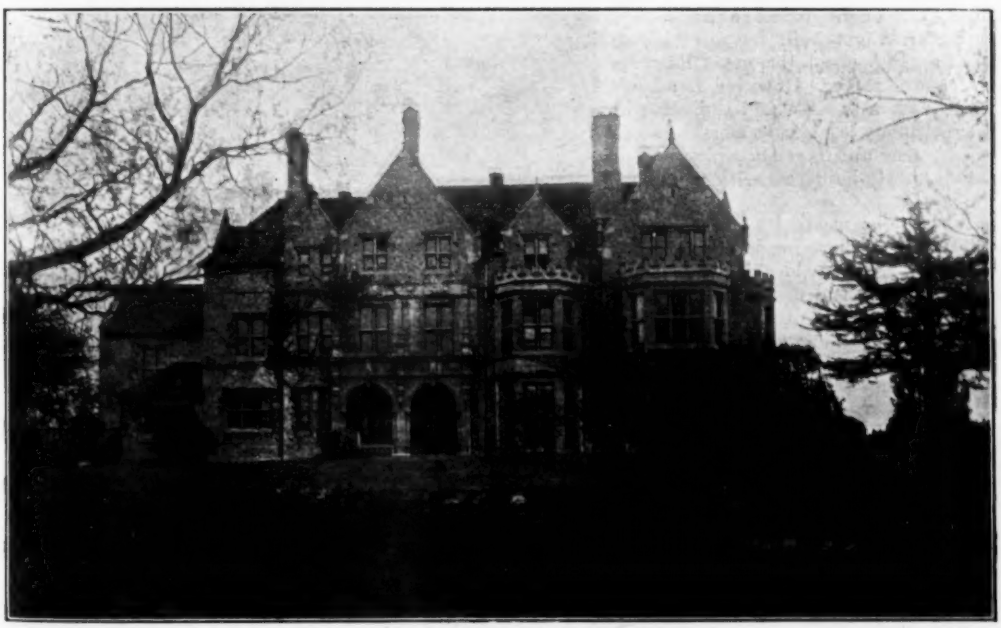
CHERWELL HALL, OXFORD.

IT is not to every one that it is given to put his theories into practice, but here in Oxford is a realised theory, and very attractive is the effect produced. Few Training Colleges are endowed with so many advantages as Cherwell Hall, and not least among these is the beauty of its situation. It stands in one of the most lovely spots in Oxford, with the Cherwell flowing past the grounds, Christ Church meadows on the other side, and above the trees a distant view of Merton and Queen's, and Great Tom, and the Radcliffe dome, while Magdalen Tower looks down upon it in ever changing beauty like a presiding genius. It is a spot to inspire any youthful soul with enthusiasms, still more so when through the soft damp air steals the subtle influence of Oxford thought and Oxford culture, an influence which clings around the ancient walls and



Cherwell Hall.

spires, diffuses itself stilly through the streets, and makes the heart and mind of the temporary dweller other than before.

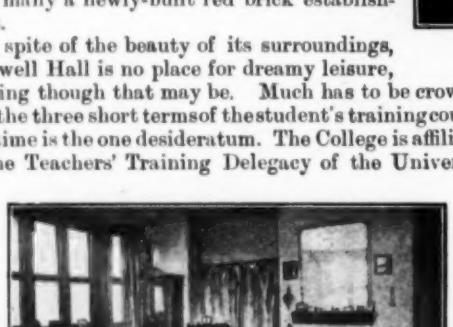
Cherwell Hall is a comfortable modern house, with a handsome well staircase, and a charming abundance of

LECTURE HALL.

windows. It is already too small for its present purpose, and some day it may probably be more collegiate and less homely in appearance with the addition of a new wing.

At the gates is Milham Ford School, which has lately become the property of the Council of the College, as a model school for the students. It stands at the edge of the old ford, on what used to be the main road from London to Oxford before the advent of Magdalen Bridge. It is a quaint, rambling old house—a house that ought to have a history, and was certainly not built for anything so peaceful as a girls' school, for one of its walls is nearly a yard thick. However, it adapts itself well to its new uses, and the removal of some superfluous bricks and mortar makes it quite as roomy and far more picturesque than many a newly-built red brick establishment.

In spite of the beauty of its surroundings, Cherwell Hall is no place for dreamy leisure, alluring though that may be. Much has to be crowded into the three short terms of the student's training course, and time is the one desideratum. The College is affiliated to the Teachers' Training Delegacy of the University



A STUDENT'S BED-SITTING ROOM.

of Oxford, and the majority of the students read for the Oxford Diploma. They attend the lectures of the Reader in Education, and according to the usual Oxford method they write a weekly essay for him, an essay which entails a wide and varied course of reading. There are, moreover, internal lectures aud coaching given by Miss Dodd, and other members of the resident staff, and these, as well as the criticism lessons, take place in the Lecture Room, a bright and cheerful building standing in the college grounds. Here the theoretical side of the work is done, while the students have only to skirt a little copse to find a practical embodiment of the theories in the school by the river side. Lest, however, they should fondly imagine that all schools conform to Miss Dodd's ideal standard, they enlarge their experience and perchance dispel their illusions by giving each a course of lessons in some other school in the neighbourhood or further afield. At Milham Ford each student is attached to a class, in which she gives courses of lessons under the supervision of a member of the staff, who is both class-mistress in the school and lecturer in the college. Many of the students read for the Cambridge or the London diploma, and then most of the work is done with the College staff, varied by a few outside lectures in special subjects. In addition to the regular education course, Cherwell Hall also affords the opportunity, still exceptional for women, of reading theology. Lectures are given by the Principal of Wycliffe Hall, and special arrangements are being made for those who wish to read for the Archbishop's

STUDENTS' COMMON ROOM.

Certificate. Moreover, by the generosity of a kind benefactor, a Divinity Scholarship is tenable here. A few students reading for the Higher Froebel Certificate are received, and are trained on modern Kindergarten lines.

A visitor to Cherwell Hall should never omit to make the acquaintance of Milham Ford. Here, undisturbed by examinations or the pressure of convention, Miss Dodd applies her theories of the proper and harmonious development of the child, both mind and body. Here her *Lehrplan*, which has migrated *mutatis mutandis* from her late school in Manchester, continues to illustrate the principles of Froebel and of Herbart, and the children pass through the culture epochs from the days of the Greek heroes onwards. The scheme is worked out in eight classes above the Kindergarten and Transition, and by a skilful arrangement the number of teachers is economised and the size of the classes increased without any loss to the children. The classes at present existing in the school are the eighth, sixth, and fourth. Next year the children will get their removes into the seventh, fifth, and third respectively, and thus work through the entire course. Out-of-door work is a prominent feature at Milham

BRITISH MUSEUM

Ford. There are geography lessons, in which the class patrols Oxford preparatory to making an original map; there are observations on the banks of the Cherwell of the behaviour of rivers; visits to churches and colleges built in the period they are studying; and, lastly, delightful nature studies in the gardens of Cherwell Hall. The *Lehrplan* even holds out hope of some day reaching London, or Warwick, or Kenilworth.

The hockey field gives opportunity to the elder girls to develop their muscles and learn the meaning of co-operation, while the younger ones, both boys and girls, serve their country as they alone can by reviving the old English games, which this generation is for the most part content to consign to oblivion.

A Kindergarten will be opened after Christmas, and already the room is preparing to receive its little

INNER HALL AND STAIRWAY.

occupants, and developing upon its walls alluring pictures of babes and beasts and visitors from elf-land.

Lastly, the School Museum deserves our attention, a happy hunting ground for the student in search of schemes. Here are displayed pictures, charts, time-tables, portfolios of lesson notes and children's written work, specimens from educational exhibitions, reference books and suggestions of all sorts; and here will be presently added the best productions of Milham Ford itself, to inspire succeeding generations both of children and of teachers.

A Hostel has just been started to accommodate thirty boarders, who will attend the school daily. Miss Mullines, who has long taken charge of a Cheltenham school boarding-house, is at the head, and her sympathetic care of the children in her house soon inspires confidence. The fees of the school are low in order that people of limited means may have an opportunity of sending their children to a school in Oxford on modern lines.

The latest development of Cherwell Hall is the addition of graduate students working for the elementary certificate. These students receive Government grants and are specially prepared for work in primary schools, pupil-teacher classes, and training colleges.

CERTIFICATE EXAMINATION, 1907.

BOARD OF EDUCATION,
WHITEHALL, S.W.,
November 28, 1905.

SIRS,—I am directed by the Board of Education to state that the syllabus of the *Certificate Examination* 1907 will be published very shortly. Your obedient servant, E. K. CHAMBERS.

Messrs. P. Lyddon-Roberts and Denney,
Principals of the Normal Correspondence College.

THROUGH INDIA WITH T.R.H. THE PRINCE AND PRINCESS OF WALES.

(See Supplement presented with this issue.)

IT is just thirty years ago that King Edward, then Prince of Wales, visited that great portion of the Empire over which he now rules, and to-day his son is making a still more extended tour in India. It may be well, therefore, before we describe the scenes and incidents of the present visit, to ask why these royal visits should be made. In the first place, we must remember that India forms no inconsiderable part of our Empire. Its area is one-seventh of the total area of the Empire, but its population includes three-quarters of all those who live beneath the British flag; moreover, the British Government is a greater power in Asia than it is in Europe. The Prince, who will one day be at the head of the Empire, may most fittingly learn by personal observation something of this great portion of it. There is also another side to the matter: the natives of India are governed by the officials sent to India, but they do not have much opportunity of feeling or showing loyalty to an English ruler. The Viceroy, who may come for a few years, rule in ways frequently unappreciated, and then go away again, does not stand to them in the place of a sovereign to whom they feel allegiance is due. We could scarcely expect that the great mass of the native population would feel that devotion to an English ruler which the English feel to their King; but the visit of the Prince has already called forth such a strong feeling of personal loyalty and such an enthusiasm as was certainly not expected. This feeling is of great importance in making possible the good government of India, and the tour of the Prince thus has a great and beneficial influence.

Apart from any official aspects of their visit, the Prince and Princess will have a most interesting and valuable journey in that country, because it contains scenes so strange to English eyes and so infinitely varied. One writer who has spent many years in travelling through all parts of India always refers to it as a continent, and that description has much truth in it. Its area, including the Native States under British supremacy, is more than one and a half million square miles—that is, over thirty times the area of England, or about that of all Europe excluding Russia. Its population is about three hundred millions—that is, nearly ten times the population of England, or rather more than that of all Europe excluding Russia.

But the contrasts both as regards country and people which India has within itself are greater and far more impressive than any which can be found in Europe. All kinds of scenery, almost all types of climate, and many different races of mankind are represented in India. Let us look at some of the more striking features of the country. The map shows that its northern boundary is the Himalaya mountain range, a gigantic mass which no European mountains can approach in size or grandeur. With twice the average height of the Alps, it extends without a break for a distance equal to that from the Bay of Biscay to the Black Sea. The peaks, gorges, and glaciers of the Alps seem utterly insignificant beside those of the Himalayas. This range is flanked on either side by more broken and lower mountains running southwards, which are on a scale more like that of the Alps, and contain passes which form "back-doors" to India.

The inward-facing slopes of these three systems comprise great tracts of mountainous territory included in the Indian Empire, and look down upon still greater tracts of lowland. As the mountains of Europe offer no parallels to the mountains of India, so the lowlands of Europe offer no parallels to those of the great, almost semicircular, area which sweeps round from the Arabian Sea to the Bay of Bengal. The Thar of the west is a typical hot, dry, and sandy desert, and the Ganges delta

Photos by Cambridge.]

VIEWS IN BOMBAY.

1. Esplanade, showing (from left to right) Public Works Office, Rajabai Clock Tower, University, and Government "Secretariat." 2. Esplanade Road. 3. Victoria Railway Terminus.

of the east is a hot, reeking swamp, while the country between embraces every variety of steppe, grass-land, and fertile fields. The peninsular part of India is mainly a tableland, rising from a fairly wide coastal plain in the east by a broken edge of varying height; this Deccan plateau increases in elevation towards the west, and culminates in the forest-clad Western Ghats. These mountains reach a height of from 2000 to 6000 feet, and present an unbroken front to a narrow coastal plain, thus suggesting the "landing-stairs" from which their name "Ghats" is taken. In this southern region again are found all types of country, from bare rocky uplands to lowlands covered with dense tropical vegetation.

The peoples of India vary no less. India has suffered from invasion after invasion till it is a veritable museum as regards races, languages, and religions. Here again all Europe presents no contrasts so great as those to be met with in a few square miles of this land. The peoples may be divided into three main racial divisions, but each of these may be subdivided again and again, and there has been such mixing and blending that no map can adequately express their present distribution. Yet it is necessary for us to have some idea of these peoples, and how they came to be living side by side, or we shall not be able to understand many of the scenes of this land.

In the wildest part of the hills and jungles of the centre of India are to be found the descendants of the oldest inhabitants of the country; these Kolarian tribes, as they are called, now form but a very small portion of the population, as they have been displaced from all but a few remote regions. They are rather lower in the scale of humanity than the Dravidians, who came next, but very long afterwards, and now form about one-fifth of the total population. The Dravidians are a backward race, small in stature—they have even been described as dwarfs—and they themselves have been driven before other races who invaded India from the north-west; hence they are to be found almost entirely in the Deccan and mainly in the south-western portion of the peninsula. They have crossed the Palk Strait to Ceylon, but the southern part of the island is inhabited by a totally different people, the Singhalese.

The races who gradually displaced the Dravidians in Northern India are more akin to the English—they are the Aryans. They first invaded the country about two thousand years B.C., but wave after wave of conquest followed, and also gradually the hot, enervating climate of India altered the appearance and character of these races, so that at the present time they differ very much from the other Aryans who have been settled in temperate regions, such as England, for thousands of years. The Aryans form the chief element of the people of the north-west part of the Deccan, the semicircular plain of the Indus and Ganges, and the mountain districts of the north-west. They amount to seventy-five per cent. of the population, and in general are the finest peoples of India in regard to appearance, physique, and mental characteristics, although we must not here fall into the too common error of supposing these peoples to be alike throughout the country. The effeminate Bengali is proverbially contrasted with the stalwart Sikhs from the Punjab and the warlike Rajputs from Rajputana. But there is still another race, akin to the Chinese, which is found in Burma and the hill countries between the Ganges and Thibet. This is the Mongolian race, but it only includes about three per cent. of the population.

These widely differing nationalities have their counterpart in the widely differing languages. There are nearly eighty tongues spoken in various parts, and it is said that about forty of these can be heard in the bazaar of Bombay. The differences in language have been one of the greatest factors in preventing the unity of the people; common action against invaders is practically impossible for this reason alone, and the differences in religion make union still more difficult.

The religions of India do not correspond to the races, and they are as difficult to define and mark out upon a

map. Perhaps the easiest way to understand their distribution is to look at their history. The earliest inhabitants of the country had no religion worthy of the name; but the Aryans, who called themselves Hindus, developed a religion which had several good features, but later became greatly corrupted. They held the belief that the souls of living animals and men passed at death into the bodies of other animals or men according to the way in which the first life was lived. The soul of a good man would pass into the body of a man of higher rank, and the soul of a bad man into some animal of a low kind.

Several centuries before Christ, when this religion had become very degraded, a teacher who was afterwards called Buddha taught that the Hindu beliefs and superstitions were in many instances wrong and horrible, and he showed in his own life a noble example of virtue, purity, and love. His followers, with the aid of a great king who lived in the eastern part of the great plain, made his teaching the basis of a religion which spread over much of India and thence to neighbouring countries, where it is still very important. But the Buddhist religion was checked and almost exterminated by a revival of Hinduism, and to-day in India Buddhism is found almost solely among the Mongolian race. The modern Hindu religion is really a loose mixture of degraded beliefs, superstitions, and social customs, but it is professed by three-quarters of the people.

The religion which comes second to it in point of numbers is Mohammedanism. This was introduced by the Arabian conquerors who came into India a little while before William I. conquered England. Two great waves of invasion followed this, and a descendant of a conqueror from Tartary assumed the title of the "Great Mogul" at Delhi when Henry VIII. was our king. His successors ruled at Delhi till Queen Victoria became Empress of India; but meanwhile separate states and kingdoms had been formed in all parts of

NATIVE STREET, WITH PALMS, BOMBAY.

the country. Also many of the Hindus had become more or less Mohammedan in religion, although they retained many of their old customs and ceremonies.

Thus, although there has often been bitter enmity and conflict between Mohammedan and Hindu, the social arrangement of "caste" is almost universal. The Hindus are divided into four great caste divisions: the Brahmins or priests, the warriors, the traders, and the labourers. These divisions are again subdivided, so that there are in all over a thousand well-marked

BOMBAY: ISLAND, TOWN, AND HARBOUR.

castes, as well as those unfortunate people who have no caste at all, and are called Pariahs. The Brahmins number some twenty millions, and form a priesthood which lives upon the workers, as a rule exerting a great and baleful influence, for they represent and perpetuate the worst features of Hinduism. The warrior caste, as one might imagine, includes some of the finest specimens of manhood, for example, the Rajputs; but the days are gone when India was the happy hunting-ground of the soldier of fortune. The coming of the English has meant the pacification of the land, to the great advantage of most of the people, but there is little room, save in the native army, for the warrior.

The trading caste, above all, has benefited by the change. The merchants have literally prospered and grown fat, for wealth to a Hindu means the ability to gorge on sweetmeats and similar dainties. The money-lending community have caused a serious problem, for many of the lowest caste, the labourers, who are mostly agriculturists, are under their heel.

The labourers form the large majority of the people of India, and exist in wretched poverty; misery is their lot, and starvation or fever is frequently their end. India is stated to be the poorest country in the world, and indeed the average income is something like thirty shillings a year. The mass of the people are patient, submissive, industrious in a quiet kind of way, and have no idea of improving their position or advancing in any direction. The caste system settles the trade of a man, and his sons and grandsons must follow the same calling. The caste distinctions are most strict, and to a Western mind quaint and even ridiculous. A man "loses caste"

if he eats with one of a lower caste, or has his food cooked by or near one of a lower caste; the food, too, must be of a certain kind—the flesh of cows or of pigs is forbidden. The Hindu must not touch an inferior, and touching the garments or coming in the shadow of an inferior is a very serious matter; also, especially at festival times, caste-marks are painted on the forehead. The prohibitions, punishments, and ceremonies of the caste system seem endless and quite baffling in their complexity, as every European who has to deal with natives finds to his cost. The government of the country is very difficult because of these strange features of native life, and it must be borne in mind that the Europeans themselves are "out caste" and unclean from the Hindu standpoint.

A Street Barber.

Now to return to the subject of the present tour: two more points are worthy of our attention before we follow the Prince through the country. We may ask: "Why is this time of the year chosen for the visit?" The answer depends upon the great peculiarity of the climate of India—its monsoon character. In the summer, the land of India and the great landmass of Asia behind become very greatly heated; the weather is unbearably hot in the first place, and also currents of air from the ocean are set up, which bring to most parts very heavy rains. This would altogether spoil a visit, but the coming of the rains nevertheless gladdens the hearts of the people, for on this summer rainfall they depend for their harvest. Sometimes these monsoon rains fail, and then we hear of terrible famines, for the country is almost entirely agricultural, and when harvests fail there is no other way in which the people can get a living. An Indian famine is a fearful thing, and when it occurs, although the English officials do their utmost to afford relief, the suffering and mortality can scarcely be realised by us in our more favoured land.

During his tour the Prince will see much that his father did not see thirty years ago. Railways have been so greatly extended that many places that could not then be visited can now be reached in comfort; the boundaries of the land have been extended; there are many other evidences of British rule which will be inspected, and as an instance we may mention the great irrigation works whereby land previously useless for lack of water has been rendered fruitful soil.

As the presentation map shows, the Prince landed at Bombay, the Gate of India, and the meeting-place of East and West. This is the entry to India for most of the immigrants; the magnitude and convenience of the harbour can be seen from the plan of Bombay, and it must be added that it is the only good harbour for shipping on this part of the coast. The city is a babel of tongues and a kaleidoscope of strange features and strange dresses, which at times form a bewildering blaze of colour in the brilliant sunshine. Besides the sufficiently varied inhabitants of India, one here sees specimens of the races of all Asia, from Jews of Baghdad and fierce Afghan horse-dealers from the west to the less common immigrants from the Malay region and China in the far east. The traffic of the streets is as varied; side by side are European carriages and Oriental palanquins, while carts drawn by bullocks with humps are obstacles to motor-cars and bicycles.

The buildings present a similar contrast between Eastern and Western life. The railway station shown in the illustration is certainly among the greatest and finest in the world. It seems typical of the British occupation, for the railway is one of the chief factors in that transformation of India which is in progress. The other great public buildings are similarly suggestive. Besides the Government buildings, there are the University buildings, for the wealthier natives must have their sons educated in Western style, and also the Law Courts, for the people seem to delight in litigation, and the native Bar is the refuge of the many educated natives who cannot obtain an appointment under the Government. The broad, imposing thoroughfares are worthy of any city in the world, but so close is East to West that in places one needs but to cross a street and one is in a part of the native town—one has gone at a step from England to India. Here the houses are often mere huts, with roofs of plaited leaves, and the twisting narrow streets are filthy and malodorous, packed close with humanity of all shades. "Teeming" and "swarming" seem the best adjectives to describe the population of the poorer native quarters. There is little privacy in the native life; men sleep, dress, and wash in public, and, as the illustration shows, the barber plies his trade in the street wherever he may find a customer.

A very interesting feature of Bombay is the Parsi community, of Persian origin, who have settled mainly in Bombay and have in many cases grown exceedingly wealthy. They have a distinctive dress, or if they have adopted European clothes, at least retain their headgear, which has been described as "a linoleum helmet, something between a Prussian grenadier's and a fly-paper man's." The "Towers of Silence," where they place their dead, are on the extreme western coast; their position is shown on the plan of the town. On the top of the towers are platforms on which the bodies are placed, to be eaten almost immediately by numbers of horrible vultures which are always waiting.

The Parsis are frequently money-lenders, and both they and other natives are owners of the big cotton-mills which are now very numerous. The extreme wealth of such natives and the extreme poverty of the vast majority form one of the most striking contrasts of this city of contrasts. The wealthy native has his motor-car, and perhaps his European chauffeur. Indeed

in several ways he is putting the European into an inferior position. You will see that Bombay is on an island; the room for building is therefore limited, and further, much of the ground, especially in the northern part of the island, is merely a reclaimed mud-flat. The wealthy native now desires the higher positions which surround the "Back Bay," and is ousting the Englishman, who usually depends only upon his rather meagre salary, into the lower parts. The Europeans are being crowded into flats, which they rent from the Parsis, and have even had to take to tents.

The poorer native has a very miserable lot. One of the things that horrifies the English visitor is the plague, which is now constantly with the people, and at this time of the year may carry off over one hundred victims each day. The plague mark is to be seen on a very great number of the houses: a red circle with the date of the dread visit of Death painted in it. The rapid spread of the plague and the difficulty of combating it, are easily understood after a visit to some of the great tenement houses. These are storey upon storey high, unlike the houses elsewhere in India, again, because of the limited amount of suitable ground on the island. In spite of the efforts of the municipality, these rabbit warrens are a mass of small dark rooms with earthen floors, where light and ventilation are considered of no account.

This is an unpleasant picture, and one turns with relief to the brighter aspects of the city. The Prince's visit came just upon the Festival of Lamps. All the town was then illuminated, every Hindu house having its light in honour of the goddess they commemorate. The temples were gaily lit up and lavishly decorated, the Mohammedans, Parsis, and Jews being in a minority who alone do not rejoice in the festivities. Such occasions have in the past frequently given rise to riots between the Hindus and the Mohammedans; but the British rule, in this as in greater matters, has brought peace, and the native police and soldiers are usually quite able to preserve order among a people who are naturally docile, save when their religious fanaticism causes a rare outbreak.

BY MANY HANDS.

"Quot homines, tot sententiæ."

WE are glad to note that the views we expressed in our last issue in this column were shared by the meeting of educationalists and others at University College. A discussion on co-education took place, and the Rev. Cecil Grant, M.A., read a paper advocating mixed schools for boys and girls. He said they should be free like the big public schools, and, like them, be on a large scale. He claimed for co-education that it afforded the only true and real standard of perfect health and purity of life.

THE rev. gentleman urged that it was a departure from Nature to have separate schools for boys and girls. Association and comradeship in lesson-time and play-time were mutually advantageous. Co-education would lift from their schools the perpetual shadow of immorality. He urged also the necessity of religion as a part of co-education.

AT the evening sitting, Dr. Perceval, Bishop of Hereford, said he had learned enough to see the great advantages of co-education. Dr. Boyd, then head of St. Andrews, had said to him, "It refines the boys; it does not hurt the girls." We trust such testimony as this will allay the fears of Lady Verney, of the Buckinghamshire Education Committee.

ONE of these days science will locate the bacteria of pessimism, and then we shall surely have a minimum of persons troubled with "more pangs and fears than wars or women have." A well-known public personality, with "tears in his eyes and distraction in his aspect," has discovered that Nature-study reveals so much cruelty and suffering as to be incompatible with belief in a merciful Creator. Perhaps he was not unmindful of Tennyson, who tells us, "Nature is red in tooth and claw." We are not prepared to admit, however, that it is impossible to establish a connecting link between science and religion; and furthermore, so far from the twain being antagonistic, they must and do go hand in hand. A personal acquaintance with some of the deepest students of Nature in modern times has revealed to us, that the deeper the knowledge of Nature's ways, the deeper the religious conviction, and we anticipate nothing but good from the teaching of Nature-study in our schools.

MAY we offer a suggestion to the Scarborough Conference Committee? We believe Scarborough, like most Yorkshire towns, can put together a respectable musical chorus, and we have also recollections of a local amateur orchestra of no mean merit. If the committee responsible for the entertainments can conveniently bring together a Yorkshire chorus for the evidently inevitable conversazione, it would not only be a musical treat, but from the admitted strength of Yorkshire lungs, we might hope to be spared hearing on all hands snatches of "shoppy" conversation, which it seems even a conversazione cannot blight

WE are sure the majority of the delegates will agree with us that a programme made up of individual items is not suitable for such a numerous assembly. To impress so large a body of people there must be more volume of sound. We are interested no doubt if some local tenor informs us that his love "is like a red, red rose," or words to that effect; but having no personal knowledge of the lady, we cannot work up that degree of enthusiasm which she doubtless merits. Furthermore, a single-voiced effort in a vast hall with a couple of thousand people more or less on the move, is about as effective as a cricket in a ten-acre field. Therefore we say the chorus is the thing.

N.U.T. NOTES.

JUST twelve years ago, the members of the Federal Committee, at the close of a protracted meeting held at the Flying Horse Hotel, Nottingham, heard with regret and deepest sorrow of the death of Alfred Richmond, one of the "straightest" and sturdiest unionists it has been my privilege to be acquainted with. He was known to be dangerously ill, and though his demise came as a heavy blow to all his friends, they were not quite unprepared for the sad intelligence. For a dozen years the N.F.A.T. has enjoyed immunity from mortality amongst its officers, and now, without any warning—without even his fellow-teachers in the same city being aware of his illness—Mr. George Carr has passed away to his long rest. I heard the fatal news on the eve of some committee meetings at Russell Square, and rarely have I seen a body of *men* so much affected, and at the same time so sorely distressed, as those whose good fortune it had been to work with him round a council table. In conversation with men who had seen him most recently, I gathered that Mr. Carr had not enjoyed very good health latterly, but still, no one anticipated his departure from our midst with such terrible suddenness. He became a member of the Federal Committee at the Bradford Conference of 1897, and had the honour of heading the poll on that occasion. He had previously achieved the highest distinctions in the Bradford Class Teachers' Association, and in the local branch of the N.U.T., whilst, in addition, he had represented both organisations at many annual conferences. He abundantly justified his promotion to the N.F.A.T. Committee, and advanced step by step until he attained the Presidency; and a brilliantly successful year of office was the result. After Mr. Ruse became a head-master, Mr. Carr was unanimously chosen to succeed him as Treasurer, and in this office gave the highest satisfaction during the last two years. He was a man of many sides, a sterling unionist, a great-hearted worker for the B. and O. funds, a capital organiser, and a most capable speaker. His death is a deplorable loss to his profession and the professional organisations; but who can attempt to estimate the bereavement of his sorrowing widow and family, to whom are tenderly accorded the deepest sympathies of his grief-stricken fellow-workers.

The late Mr. George W. Carr.

IN my November "Notes" I related the abortive attempt of Messrs. A. E. Cook and H. J. Wood to secure the support of the Assistants' Federation for Mr. W. A. Nicholls, in the event of this gentleman being nominated for the Vice-Presidency of the Union, and went on to say: "In my opinion, *Mr. Nicholls is the one man able to win the blue riband of the Union for the metropolis.*" His friends and admirers have not been at all dismayed by the Hull failure, but have proceeded to nominate him for the Vice-Presidency, and for this distinction he will secure considerable support. My duties at Russell Square naturally cause me to be in frequent contact with representative London teachers; and, rightly or wrongly, I have come to the conclusion that Mr. Nicholls is the most popular and capable President the London Teachers' Association has had for many a year. If this estimate is correct, then it is certain that his accession to "V.-P." honours cannot be long delayed. He will not succeed at the "first time of asking," for 'tis *res judicata* that Mr. A. R. Pickles, B.A., will be acclaimed the new king at Scarborough. At the Executive, I can say quite frankly that Mr. Nicholls is both esteemed and liked; and I shall never forget how, in the face of a hostile Conference, he, at Portsmouth, made a manful stand for the unpopular (and bankrupt) library. At the time this paragraph is penned, I am not certain whether Messrs. Blackburn and Phillips will again take the field. My firm conviction, however, is that each of these well-qualified gentlemen will have to stand down until Messrs. Pickles and Nicholls have passed through the Presidential chair. We shall see!

A new "V.-P." Candidate.

AS long as I can remember, the settled policy of the N.U.T. has been to secure equal privileges for every holder of the teachers' certificate, whether he has passed through a college course or received his training in some other way. When visiting training colleges as a Union missionary, I have frequently been "heckled" on this point, the college authorities contending that those who devote two or three years to acquiring high qualifications for their profession (to say nothing of incurring considerable personal expenditure) ought to be remunerated in some superior fashion. My reply has invariably been that so long as the training college accommodation is lamentably deficient, and so long as admission to existing colleges is not so much a matter of ability and capacity but rather of readiness to profess adhesion to a particular dogma or form of faith, it is quite unfair to label the non-collegiate teachers as inferior in any way to their college-trained brothers and sisters. I am, however, beginning to wonder whether this policy is working out in quite the desired way; for I view with alarm the growing indisposition on the part of a very large section of young teachers to contemplate entering a training college at all. A thorough examination of the list of successful teachers at the last King's Scholarship Examination has shown me that no less than 434 of the 2242 successful men, and 5351 of the 9242 successful women, declared, before they set pen to paper, that no matter what position they secured on the list, they did not propose to enter any training college. My own decided view is that the time has arrived when the Board of Education should require every boy and girl entering on an apprenticeship as pupil teachers to undergo a college training at its close, and should give notice that, (say) five years from this date, the "acting teachers'" examination for the certificate would be abolished. The enormous extension of accommodation in day training colleges has rendered the "religious" difficulty much less acute than it was ten years ago.

The "Acting Teachers'" Examination.

A. C.

NOTES FROM THE NORTH.

ONE of the most important questions agitating the minds of teachers at present is the tenure of the teachers. The cases of tenure that are at present cropping up are no doubt due to the fact that while the sword of Damocles hung over the life of School Boards they elected to keep quiet. Something, however, will require to be done to bridge over the time between now and the introduction of educational legislation. It has been suggested that a Bill of one clause dealing

Tenure.

with tenure might be introduced at the beginning of the new session. Various courts of appeal have been suggested. It has been thought that teachers might have the right of appeal to the Sheriff or to the Education Department. I question if the former of these would be satisfactory, and there are some doubts as to whether the Education Department would be willing to incur the responsibility. Other two courts have been suggested, namely, the Secondary Committees and the new Provincial Councils for Training. The Secondary Committees, even though they were considerably strengthened, would not, I fear, meet with the approbation of teachers. In the first place they are not popularly elected, and are responsible to no one. In the second place, they have nothing at present to do with the control of education; their function is simply to spend the money allocated for education.

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TO my mind the Provincial Councils would make admirable courts of appeal. They are four in number. To them have been co-opted the teacher element, so that there is every likelihood of the teacher's case being thoroughly considered. These committees are far enough removed from petty jealousies and parochial bitterness. They consist of the chairmen of the School Boards and several members taken from the University Court. They would be unprejudiced. Then, again, from the fact that they are taking the training of teachers under their charge, it is but right that the termination as well as the beginning of a teacher's career should be entrusted to them. No more powerful court of appeal could be suggested, and I trust that the new Government will pass such an Act. The recrudescence of tenure cases is at present bringing home the question to the minds both of teachers and the public. The many cases of hardship which fall short of dismissal are as eloquent in their appeal for legislation as the actual cases of dismissal.

Appeal to the Provincial Committees.

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IN many parts of Scotland there exist most cordial relations between the inspectors and teachers, but nevertheless it is becoming more and more necessary for more frequent interchange of opinion. The inspector's relationship to the teacher and to the school is now much changed from what it was a few years ago, and there is great need for friendly advice and consultation. The introduction of fads has yet to be resisted. The overcrowding of curriculum is still a clamant evil. In some quarters School Boards are conducting examinations irrespective of the examinations of the inspectors. This means distrust of some one or other. The interests of the inspectors and the teachers are here identical, hence the necessity for more mutual co-operation and consultation. If there should be frequent meetings of a staff and a headmaster as regards the curriculum and working of a school, so there should be frequent meetings for consultation between the head teachers and inspectors. All are working towards the same end—the good of education—and this can be best secured by discussion of the best methods. Inspectors have much to learn, teachers have much to learn, and the greatest good would accrue from such meetings as I have suggested.

Inspectors and Teachers.

THE various Provincial Committees are now in working order. There are in the air rumours of great and far-reaching changes with regard to the future training of teachers. It is believed that the days of the pupil teacher are numbered. Candidates for the teaching profession will likely be educated in some of our Higher Grade Schools. There they will receive the scholarship necessary. In finishing they will go to the University and Training College, and in connection with their studies there they will be trained in the practical part of their work in schools. Masters of method will doubtless be appointed for this work. As a result of the abolition of the pupil teacher, there will in future be no acting teachers. Those who are unable by their scholarship to pass the preliminary examinations for teaching will be given a sufficient time to qualify them to do so, and on their failing they will be cast adrift. The back doors to the profession would thus be effectually locked. One important result of all this will be that the teachers who propose to enter our Secondary Schools will likewise receive a training; at present this is not always so. There will thus be a future for teachers. It will help the profession very materially.

The Training Committees.

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THE Institute Congress arrangements are now complete. It is to last three days, Wednesday, Thursday, and Friday, 3rd, 4th, and 5th January 1906. The degree of Honorary F.E.I.S. is to be presented to Lord Balfour and Lord Elgin, for the valuable work they have done for education. Papers are to be delivered by Dr. Dunn, H.M.I., and Professor Jones, Glasgow University, on the first day. On the second day Herbert Paul, Esq., M.P., Wm. Jones, Esq., M.P., Carnarvon, Mrs. Creighton and Mrs. Bosanquet are to give addresses. The Friday is reserved for purely professional questions. The various functions usually associated with Congress are in evidence. It is hoped that there will be full and free discussion of the papers, and that Dunfermline Congress will be one of the best we have had.

Institute Congress.

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THE question of Superannuation is the all-important one just now with the branches. The Superannuation Committee has sent down a most important circular, and has asked the associations to give answers to the following queries:—

1. Is your branch in favour of making the teacher's contribution to the Annuity Fund in proportion to salary?

2. Is your branch, having due regard to the serious diminution in the resultant annuity, in favour of—

(*a*) the optional retiral of men at sixty?

(*b*) the optional retiral of women at fifty-five?

3. Is your branch, having due regard to the serious diminution in the resultant annuity, in favour of an alteration of the basis upon which the Annuity Fund is constructed at present, so as to allow the teacher's contribution being returnable to—

(*a*) the contributor upon his (or her) leaving the profession before reaching sixty-five years of age?

(*b*) his (or her) representatives upon the death of the contributor before reaching sixty-five years of age?

R. D.

E.I.S. Doings.

THE NEW PRESIDENT OF THE BOARD OF EDUCATION.

THE new President of the Board of Education is at present without a seat in either House of Parliament For although Mr. Augustine Birrell, who has

MR. AUGUSTINE BIRRELL, K.C.

just received that appointment, represented West Fifeshire from 1889 to 1900, he was unsuccessful in his attempt to capture a Conservative seat in North-East Manchester in 1900. Mr. Birrell was born at Liverpool in 1850, and has proved himself an acute and capable man of law. He has not only been very successful at the Bar, but has also held the Professorship of Law at University College, London. He has devoted much time to the study of literature, and has achieved no small fame as an author himself. His works include *Obiter Dicta*, *Life of Charlotte Brontë*, *Men, Women, and Books;* and a life of his friend Sir Frank Lockwood, besides *Collected Essays* and *Miscellanies.*

He is a powerful party politician, and in 1894 was President of the National Liberal Federation. He is an able speaker, quick and ready at seizing a point, and full of paradoxes and dry humour. Knowing the relation that the Bench bears to the Bar, we trust that he will see the enormous advantage that will accrue to education if he uses the opportunities afforded by his office to establish the same relation between the teaching profession and the inspectorate, and do his best to rid education of those class prejudices which are its bane.

THE LATE SIR RICHARD JEBB.

BRITISH classical scholarship has lost one of its brightest lights by the death of Sir Richard Jebb on December 9. In a sense he represents all three parts of the United Kingdom, for he was born in Scotland in 1841, and received his earliest education at St. Columba's College, Rathfarnham, Ireland. From this college he came over to the Charterhouse—the school of Addison, Steele, and Thackeray—and by the time he entered Trinity College, Cambridge, he was such a brilliant scholar that it is said he could have taken a First Class in the Classical Tripos straight away. In 1863 he obtained a Fellowship of his College, and six years later was appointed Public Orator of the University—a post in which he was required to make speeches in Latin. He made a great name as classical lecturer at Cambridge, and in 1875 he was appointed Professor of Greek at Glasgow University. He helped to establish the school of archæology in Athens, and his profound knowledge of the Greek language was recognised by the King of Greece, who bestowed on him the Order of the Saviour. In 1889 Sir Richard Jebb was appointed Regius Professor of Greek at Cambridge, which is perhaps the highest honour that can

THE LATE SIR RICHARD JEBB.

be bestowed on classical scholarship. Sir Richard also represented his University in Parliament, and was one of the Trustees of the British Museum.

THE LAW AFFECTING SCHOOL DISCIPLINE.

BY T. A. ORGAN, B.A.,

Barrister-at-Law, of the Inner Temple and the Oxford Circuit.

Parental Duties and Rights.— From time immemorial the right of a parent to punish and restrain his child has existed. In ancient Rome this power was unlimited, and extended even to life and death. But the existing English law puts limits upon this power, and does not permit a parent to do more than punish and restrain his child in a reasonable and proper manner.

"It is a parent's duty," said Mr. Justice Field, "if the child will not do what he advises it to do, to take whatever steps he considers reasonably necessary for

its correction. But he must act honestly in this course. There must be a cause which a reasonable father honestly believes requires punishment. In a case of a mere childish fault, for a parent to use weapons would be so unreasonable as to destroy a parent's right. The law therefore does justify a parent, in a case where he honestly considers correction necessary, in administering blows in a reasonable and proper manner. And this power is not limited to corporal punishment, but extends to detention and restraint." (Hutt *v.* The Governors of Haileybury College and ors.)

Delegation, the Basis of the Teacher's Authority to Punish.—It is within the power of a parent to delegate to the teacher of his child such rights of punishment and restraint as he (the parent) possesses. The parent may delegate all or any of these rights. Unless otherwise specifically agreed, when sending his child to school the schoolmaster receives from the parent the same right of punishment that he possesses. Not infrequently, however, under modern conditions, the right of the teacher to punish is limited by regulations laid down by the school authority, and when such regulations exist they are binding upon the teacher, for they form part of the contract entered into when the child is admitted as a scholar. It was clearly laid down in the Haileybury College case, that the father parts with his powers, and delegates them to the master under whose charge he places the child, and that, *unless limited by special contract*, the master has the power of determining when a punishment is required, and also to what extent. In a comparatively recent case (1893), in giving his decision the judge said, "It is clear law that the father has the right of administering reasonable personal chastisement to his son, and it is also equally clear law—and certainly sanctioned by very ancient practice—that the father is taken to delegate to the schoolmaster the same right of corporal punishment that he himself possesses." (Cleary *v.* Booth.)

Not until the year 1899 was there reference in any statute to the right of the parent or the teacher to administer punishment to a child. In the year 1899, however, an Act was passed, in one section of which the existing common law right was specifically recognised. This section reads: "Nothing in this Act is to be construed to take away or affect the right of any parent, teacher, or other person having the lawful control of the child, to administer punishment to the child." (Prevention of Cruelty to Children Act, 1899.)

Punishment must be Reasonable and Moderate.—Whatever the form of punishment, it must be reasonable and moderate. If the child is punished by being deprived of its usual liberty, the deprivation must not be extended to an unreasonable time, nor must it be under circumstances which would cause an undue strain upon either the physical powers or the mental faculties of the culprit. For instance, the imprisonment of a nervous child in a dark room might be reasonably held to be an immoderate and dangerous form of punishment. Again, a severe punishment for moral delinquency is not unreasonable, while similar punishment for the childish fault of mere carelessness would be reprehensible. The age and physical condition of the child are additional factors which must be taken into consideration when determining whether any particular punishment has exceeded the bounds set by the law. It is patent that a reasonable and moderate punishment inflicted upon a healthy lad of fourteen might become unreasonable and immoderate if inflicted on a weakly ten-year-old girl. Formulated as a general proposition, it may be said that it is not possible to define "moderate and reasonable punishment" with any degree of accuracy; all that can be said is that each case must be determined on its merits. The following are authoritative statements on the point dealt with in this paragraph:—

(1) "It is a case of great importance, for on the one hand it is for the general benefit of society, and especially of its youth, that the authority of those charged with the care of great scholastic establishments should be maintained; and on the other hand, it is of equal importance that it should not be exercised arbitrarily. That it has been exercised honestly in this case there can, I think, be no doubt. The question is, whether it has been exercised reasonably or unreasonably, and according to your view upon that question your verdict for the plaintiff or the defendant must in the main depend." (Fitzgerald *v.* Northcote.)

(2) "By the law of England the parent or schoolmaster, who for this purpose represents the parent, and has the parental authority delegated to him, may, for the purpose of correcting what is evil in the child, inflict moderate and reasonable corporal punishment—always, however, with this condition, that it is moderate and reasonable. If it be administered for the gratification of passion or rage, or if it be protracted beyond the child's power of endurance, in all such cases the punishment is excessive and violent and is unlawful; and if evil consequences to life or limb ensue, then the person inflicting it is answerable to the law, and if death ensues, it will be manslaughter." (Reg. *v.* Hopley.)

(3) "It is his (the parent's) duty, if the child will not do what he advises it to do, to take whatever steps he considers reasonably necessary for its correction; but he must act honestly in this course. There must be a cause which a reasonable father honestly believes requires punishment. . . . The law, therefore, does justify a parent, in a case where he honestly considers correction necessary, in administering blows in a reasonable and proper manner. The father parts with all these powers, and delegates them to the master under whose charge he places the child." (Hutt *v.* Governors of Haileybury College and ors.)

(4) "Reasonableness of the punishment must be determined by the varying circumstances of the particular case. The burden of proving unreasonableness rests on the prosecution, there being a presumption that the teacher has done his duty. It does not follow that a chastisement was cruel or oppressive because pain was produced or abrasion of the skin resulted." (American State Reports.)

The Offences for which Punishment may be inflicted.—From former paragraphs in this article, it will have been gathered that the teacher's power to punish *may be* co-extensive with that of the parent. But the power of the teacher may be less than that of the parent, for the parent may delegate to the teacher only a part of his parental power. Indeed, the parent may refuse to delegate any of his powers, and in such a case any punishment inflicted by the teacher would be an assault. If no mention is made of the question of punishment when a child is admitted to a school, then it is assumed that the parent delegates to the teacher power to inflict punishment to the extent and for the offences prescribed by the regulations of the governing body of the school. If no such regulations exist, and no mention of punishment is made at the time of the admission of the scholar, then the parent tacitly delegates to the teacher all a parent's powers in this matter. Dealing with this point, when summing up in a case (Hutt *v.* Governors of Haileybury College) already quoted, Mr. Justice Field said:—

"We have all experienced, no doubt, a parent's punishments. *Unless limited by special contract*, I think the master has the power of judging when a punishment is required

and to what extent. . . . You (addressing the jury) will have to say whether the conduct of the masters in the present case was reasonable and honest. While the child remains in its own family, its interests are synonymous with those of its fellows; but when the delegation I alluded to occurs, and the child enters a public school, these interests are greatly extended, and the master must take into consideration the interests not only of one boy, but those of the whole school. No doubt there were circumstances under which a master might be called upon to decide a case upon what at the time he considered to be facts, but which eventually turned out not to be so. Would he not in such a case be justified, if the nature of the case required immediate action, and he had acted honestly, and his conclusions were under the circumstances reasonable? *What amount of power is actually delegated by a parent to a master must depend on the circumstances in each case.* These circumstances might be very greatly varied by any special terms in the contract."

It will be noted that two other important points are raised in the preceding extract. The first is, that not only the interests of the culprit are to be considered when need for punishment arises, but the interests of the whole school. Young Hutt had been expelled from Haileybury. Hutt was suspected of stealing money, and on the expulsion that followed the action at law was based. Remembering this, the remarks of the judge as to the interests of the school will be appreciated. One ought to say here, that the result of the action was to entirely clear the character of Hutt from any suspicion of blame. The second point is extremely important from the teacher's point of view. It does not appear to have been definitely decided, but the judge suggested, by means of a question to the jury, that if a teacher inflicts a punishment, having formed an opinion, after proper inquiry, that an offence has been committed, then the teacher is not exceeding his legal rights, although it may be afterwards discovered that no such offence has been committed. But, there must be facts within the teacher's knowledge which lead him honestly and reasonably to form an opinion as to the nature of the offence and the identity of the offender. In a word, the teacher must form his opinion judicially, not recklessly nor on insufficient grounds.

Limits as to Time and Place of the Offence.—When and where does the parent's delegation of power to punish commence and end? As to offences committed within the school walls, and within the ordinary school hours, no difficulty has arisen. Under certain circumstances other offences come within the purview of the teacher, as such, and he has the power to punish the offending scholar.

But it has been decided by the High Court that a boy guilty of improper conduct between his home and his school is liable to punishment by his master. From this case, it would appear that, in default of any special contract to the contrary, the law assumes that the teacher's delegated right commences to run from the time the scholar leaves his parent's home for school, and ends when the scholar reaches his home after the close of the school session. The case in which this question was raised occurred in connection with a public elementary school in Southampton. The offender, a boy, was going from school, and on his way home interfered with another scholar who attended the same school. For this offence he was punished by the headmaster on the next day, immediately after a complaint had been made by the mother of the aggrieved lad. The Southampton magistrates convicted the master, and stated their grounds for so doing in the following words: "The justices were of opinion that the schoolmaster was not entitled to punish a pupil for anything done by such pupil against another pupil, each being on their way to school, the act being committed off the school premises, and unconnected with the school." A case was granted on the question of law thus raised, and in deciding not to uphold the decision of the justices upon this point, Mr. Justice Lawrence said:—

"The cases cited to us show that the schoolmaster is in the position of the parent. What is to become of a boy between his school and his house? Is he not under the authority of his parent or of the schoolmaster? It cannot be doubted that he is; and in my opinion, among the powers delegated by the parent to the schoolmaster such a power as was exercised by the appellant in this case would be freely delegated. . . . It is difficult to express in words the extent of the schoolmaster's authority in respect of the punishment of his pupils; but in my opinion his authority extends, not only to acts done in school, but also to cases where complaint of acts done out of school, at any rate while going to and from school, is made to the schoolmaster. In the present case I think that weight may properly be placed on the fact that the act for which the boy was punished was done to another pupil of the same school. I think, therefore, that the justices were wrong in convicting the appellant as they did, and that the case must be sent back to them to find as a fact whether the punishment was excessive."

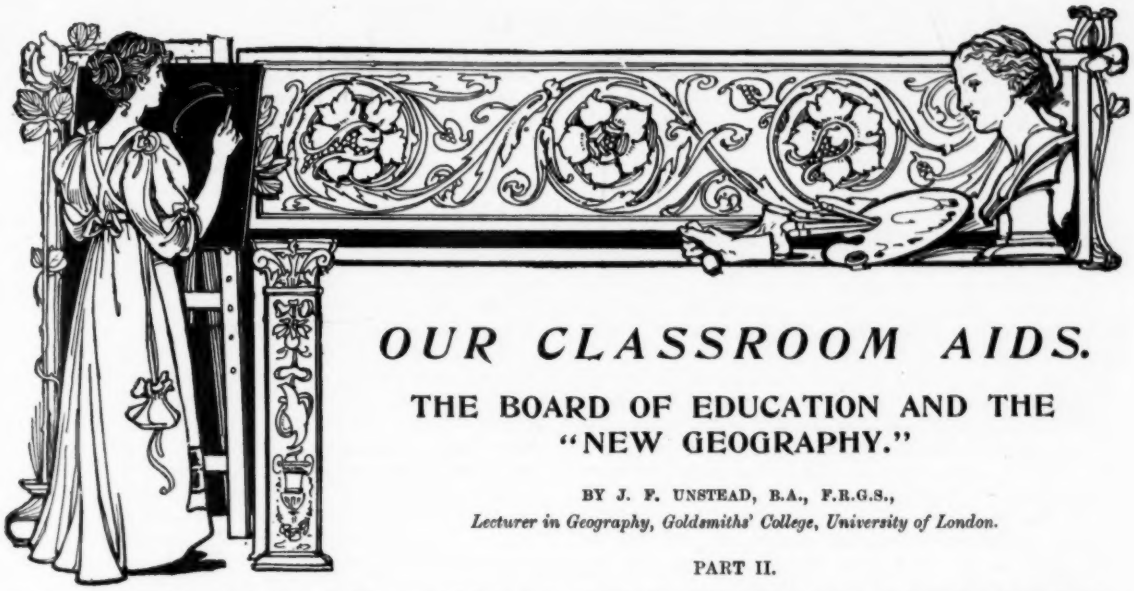
As the case came before a Divisional Court, it was heard by two judges, and Mr. Justice Collins, following Mr. Justice Lawrence, said:—

"I am of the same opinion. . . . As a matter of common sense, how far is this power (the power of punishment) delegated by the parent to the schoolmaster? Is it limited to the time during which the boy is within the four walls of the school, or does it extend in any sense beyond that limit? In my opinion the purpose with which the parental authority is delegated to the schoolmaster, who is entrusted with the bringing up and discipline of the child, must to some extent include an authority over the child while he is outside the four walls. It may be a question of fact in each case whether the conduct of the master in inflicting corporal punishment is right. Very grave consequences would result if it were held that the parent's authority was exclusive up to the door of the school, and that then, and only then, the master's authority commenced; it would be a most anomalous result to hold that, in such a case as the present, the boy who had been assaulted had no remedy by complaint to his master, who could punish the assailant by a thrashing, but must go before the magistrate to enforce a remedy between them as between citizens."

Referring to the duty of the teacher to train his scholars in morals and conduct, the judge goes on to say:—

"It cannot be that such a duty or power ceases, the moment that the pupil leaves school for home; there is not much opportunity for a boy to exhibit his moral conduct while in school under the eye of his master; the opportunity is while he is at play or outside the school; and if the schoolmaster has no control over the boys in their relation to each other, except when they are within the school walls, this object of the Code would be defeated." (The Code here mentioned is the Code of Government Regulations for Public Elementary Schools, which prescribes that the children shall be brought up in habits of good manners and language, and of consideration for others.) "In such a case as the present, it is obvious that the desired impression is best brought about by summary and immediate punishment. In my opinion, parents do contemplate such an exercise of authority by the schoolmaster. I should be sorry if I felt myself driven to come to the opposite conclusion, and am glad to be able to say that the principle shows that the authority delegated to the schoolmaster is not limited to the four walls of the school. It is always a question of fact whether the act done was outside the delegated authority; but in the present case I am satisfied, on the facts, that it was obviously within it."

(*To be continued.*)



OUR CLASSROOM AIDS.

THE BOARD OF EDUCATION AND THE "NEW GEOGRAPHY."

BY J. F. UNSTEAD, B.A., F.R.G.S.,
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PART II.

THE previous article dealt with the essential features of the "New Geography" and its great educational value. The present article will deal with the question of framing a syllabus in geography, and will consider the specimen schemes of the Board of Education. It will be clear that the subject of geography has several parts vitally connected with one another. This is indicated by the definition given in the Blue Book, a definition worth repeating: "Geography is concerned with the Earth's surface, the condition of its various parts, their relations to one another, and the influence of those conditions and relations on plant life, on animal life, and specially on human life."

The subject starts with the surface of the Earth, of which the first characteristic is its form, that of a sphere. This part of the subject is *mathematical geography*, and this term includes also the relation of the Earth to the heavenly bodies, especially to the Sun, and the way in which positions on the Earth's surface are indicated by latitude and longitude. Dependent upon the shape of the Earth and its relation to the Sun is the distribution of light and heat over the Earth. This, together with the relief of the land—the position of land and water, upland and lowland—affords the basis for the study of climates, and all these matters may conveniently be classed as *physical geography*. Next comes the influence of these physical factors upon the plant life, and then the animal life is controlled by the combined factors of relief, climate, and the plants which afford food for the animals. We may call this section *biological geography*. Finally the crown of the whole subject is the study of the way in which all the foregoing phenomena affect mankind, and that study is *human geography*. This has two important aspects. It may deal with the ways in which men get their living—their industries, whether agricultural, fishing, mining or manufacturing, and their commerce, together with the trade routes and trading centres—this aspect is *economic geography*. Human geography may also deal with the way in which the geographical conditions have affected the development of mankind and the history of nations, and this is sometimes known as *historical* or *political geography*.

Now it is obvious that all these parts of the subject must have a place in the syllabus, for without any one the chain of reasoning is incomplete, but the order in which these parts are here named is not necessarily the order in which they should be introduced to children; it is the logical but not the educational order. To indicate the order in which geography should be taught, it is necessary to divide the subject in quite another way. It may be divided according to the part of the Earth's surface which is considered. We may study the immediate neighbourhood; that is *home geography*. We may study some particular region of the world, for example, our own country or India, looking at all aspects of the chosen part—its position, relief, climate, plants, animals and people; that is *regional geography*. Lastly, we may study the world as a whole, for example, comparing the peoples of the various parts or noting the arrangement of the wind systems; that is *world geography*.

It seems agreed that children should commence with the study of their immediate surroundings, *i.e.* with home geography. In this study the first steps in plan and map making form an introduction to mathematical geography; the observation of the wearing action of streams or the noting of winds and rain forms a beginning for physical geography; the knowledge of localities which suit certain plants and animals is elementary biological geography. Thus the different branches of the subject may all be introduced quite early in the course, and the relationships observed or pointed out.

The study of some particular region of the world, even such a region as England, cannot be undertaken till later, for where the facts cannot be directly observed the imagination must reconstruct the conditions out of the ideas previously gained, as in the home geography. But the amount of such home geography taught by direct observation is limited, and in towns very strictly limited, and recourse must be made to pictures, graphic descriptions, and stories. By means of these some world geography may be introduced quite early; the younger children will delight in pictures and tales of strange men, strange animals, and strange scenes. Besides awaking interest, these will afford the necessary basis for the more systematic treatment of later years.

In this way, some of the main features of the world

geography may be taught. Thus the hot and wet climate of equatorial regions may be associated in the children's minds with the dense vegetation, the characteristic animals, and the mode of life of the natives. When the fundamental notions have been gained by such home and world geography, the regional work may be commenced, and henceforward the three kinds may go on concurrently. In successive years, each portion may be dealt with a little more thoroughly, and possibly a new region may be added for special study. The regional part, for example, may deal with England in one year, and the British Isles, Europe, and the British Empire in the following years.

This is an indication of the way in which the writer would draft a scheme, and it here serves as an introduction to considering the two Specimen Schemes of the "Suggestions." In the first scheme "the teaching is based mainly on a study of the locality, expanded from year to year." The teaching is expanded in two ways: the home geography itself is considered in successive aspects as the course proceeds, and world and regional geography are gradually introduced, fresh regions being studied year by year. Formal geography is considered unsuitable for infants, but it is suggested that stories with a geographical setting, and the clay modelling, crayon drawing, etc., may form a preparation for later systematic work.

The first year of the course deals with the meaning of geographical terms, and the qualifying phrase "as occasion requires" needs emphasis. The tradition of the old Codes has to be reversed in this respect, and the following warning given elsewhere in the book should be borne in mind: "The old plan of beginning to teach geography by making the scholars learn the definitions by heart is acknowledged to be a mistake." When the children know the essential characteristics of a land-form, *e.g.* a plateau, and have learnt these by reference to some particular example met with in their study, it is possible to give the name, and so the terms will not precede but follow the ideas, and will not be introduced in batches, but gradually as the things they denote present themselves. The suggested scheme deals next with the methods of showing the shape and size of artificial and natural objects by plans and maps, and requires that this should be done in part out of doors. The points of the compass should be taught in connection with observation of the sun's position—the south, *e.g.*, being the direction in which the sun is observed at noon.

The last portion of the paragraph says: "Towards the end of the year a globe should be shown and lessons given about typical scenes in different parts of the world marked on the globe." While one agrees entirely with the idea of giving lessons on typical scenes, one doubts whether a globe should be shown at such an early stage. The idea that the world which the children know forms part of a globe, is an abstract idea exceedingly difficult for them to grasp, and unless we are to return to the old method of simply giving facts apart from reasoning and observation, it should be left to a later stage. There is surely no need to introduce the idea so early, and indeed the scholars miss a valuable piece of mental training by so doing, for the reasons which lead us to believe that the world is a globe can be given gradually, until the final idea of the form of the earth may be reached naturally and on a firm basis of observation and reasoning about the third or fourth year.

For the second year is suggested a more careful study of the school neighbourhood and further observations of the sun; similarly, there are more detailed lessons in world geography dealing with foreign lands and their peoples. Regional geography is to be begun with the study of the part of England in which the school is situated, and taught from a blackboard sketch map and a wall map of England.

The third year introduces the orographical map, and says concerning it: "A map of the district in differently coloured chalks, according to height above sea level, should be drawn by the teacher on the blackboard, and copied by the class in the mapping book as a brushwork exercise. An orographical map of England should be shown, and another map on which political divisions are marked." Since regional geography must be studied by means of maps in place of direct observation, one wonders whether it should be commenced before the orographical map has been explained. The orographical map of England gives an idea of the country better suited to beginners than the political one coloured according to administrative counties, and therefore one suggests that this teaching of a map showing elevation might perhaps change places with the regional geography and wall map of the second year. The scheme, however, now continues the regional geography of England, attention being called to the occupations of the people in different parts and the great railway lines; also the geography of England is correlated with its history, and the old divisions of England are to be drawn on the blackboard. The world geography consists of noting contrasts between English and foreign plants and animals, and the reasons for the differences.

In the fourth year the immediate neighbourhood is to be sketched more carefully in connection with school walks, and weather observations are to be made and recorded. The regional geography is very considerably expanded: the maps of Scotland and Ireland should be studied; some instruction should be given about the oceans and seas adjacent to our shores and the value of our insular position may be pointed out; a map of the world on which British Colonies are conspicuously marked should be shown, and one or two Colonies should be studied in detail. "Systematic map drawing should now commence, and in each lesson some part of a map should be copied from the blackboard and completed in subsequent lessons." One might here suggest that the most useful maps for children to draw are those showing only one or two closely connected features of a country, *e.g.* the direction of the prevailing winds and the rainfall; that to attempt to make the map "complete" in the sense of containing a large number of such features is to overload it; and that the aim should not be to produce either a work of art or a copy of an atlas map, but to fix in the mind the distribution of certain phenomena. This idea is borne out by a phrase in the chapter on the Teaching of Geography: "The making of rough sketch maps by the scholars themselves should be a very frequent part of the teaching. Such maps should be looked upon as a form of rapid and suggestive note-making, not as exercises in elaborate lettering or colouring."

In the fifth year the scholars should be taught how to make observations of the slope of the land, and to measure heights and insert contour lines to show elevation on the maps of the district which they make. In con-

nection with the home geography, the stars and moon should be observed, and world geography is included by the injunction that simple apparatus should be devised for explaining the cause of the seasons. The regional geography is to deal with Europe, and the features to which special attention is drawn are the steamer routes and railway routes that connect us with important places on the Continent, the natural regions into which Europe may be divided and the connection between its natural and political divisions, the climates and the influence of climate upon productions and manufactures, the conspicuous features of the most important towns and the characteristic occupations of the different countries.

The sixth year is to carry the elementary surveying of the previous years a little further, and the main geological features of the neighbourhood are to be explained. The observations are to include readings from the barometer, thermometer, and rain gauge, the ascertaining of the longitude and latitude of the school, the effect of the agents that shape the Earth's surface, and the motions of the moon in connection with the explanation of the tides. As regards the regional geography, the British Empire should be more thoroughly studied, and the trade of England should be learnt with the help of diagrams drawn to show the amounts of imports and exports, and maps of the trade routes.

Such are the main features of the scheme, liberal in conception and suggestive in detail, and it cannot fail to be most valuable as a "general guide to teachers as to the lines on which progressive schemes of geography may be drawn up." Yet as the surroundings of schools and their internal characteristics vary greatly, the schemes must be adapted to the local opportunities and necessities, and each school must have its own syllabus framed by its own teachers. It is most probable that some teachers will find the above work more than they can effectively teach; they will have to select the more important parts of this syllabus and those most suited to their special conditions.

The second suggested scheme is very different from the first, and can scarcely be considered as an alternative scheme. It is not arranged in divisions consisting of the work of successive years, but is arranged according to the branches of geography considered. Indeed, it really consists of an enumeration of the various topics with which it is suggested that a teacher should deal, grouped under three main headings. The first is called "A. Physical," and its sub-headings are: The sun, Water, Volcanoes, The air, The earth, The sea, Ocean Currents. The second heading is "B. Historical," and the third is "C. Topographical and Economic." Under each heading and sub-heading the main points are noted and hints given as to how they may be taught. We select and quote as an example one of the subdivisions of the physical part.

"*The Air.*—How we are warmed and cooled by it; how the air is warmed; visible illustrations of water absorbed by the air and discharged from it, noting the conditions under which each takes place, and the form in which water, expressed from the air, becomes visible; how we should become aware of the fact if there were no water in the air. Winds; their effects in drying and cooling; what is to be learned from their direction. Air currents; how the smoke of a fire is carried upwards." Obviously such notes are valuable, but they do not form a scheme in the sense in which the first scheme does. The teacher will find it necessary to draw up his own syllabus, taking the first scheme as a general guide in principle, and may then turn to this second one to obtain help in filling in the details and to get suggestions as to methods of teaching.

The note introducing the second scheme says: "The teaching under each head should be given not separately and consecutively but concurrently, with, however, a leaning to priority in the order given." This last suggestion should be carried out with considerable discrimination. For example, the section on "*The earth*" contains these passages, *inter alia*: "The old question of what it is; why we cannot see its outline as we do that of the sun and moon; what first led observers to imagine it a sphere. . . . England on the globe; its position with reference to the poles; warmer and colder regions southwards and northwards. . . . Our part of England; what can be recognised about it. . . . First idea of a map, a small portion of a very large globe would be very similar to map of England . . ." Now these notes would surely be more valuable if the order were reversed: first, the map of the district (with no hint, however, of its forming a small portion of the surface of the globe), then our part of England, next England and the comparison with warmer and colder regions southwards and northwards, and lastly the world as a whole, that is, as a globe. In other words, one would proceed from the known to the unknown, and from the concrete ideas of the features of the neighbourhood to the abstract idea of the neighbourhood forming part of the surface of a very large globe.

It is stated in the note introducing the second scheme that "the topics given will afford material for a course lasting three or four years." One's experience leads one to think that five or six years would be required to cover all that is mentioned, and that some of the topics are perhaps too advanced for the ordinary elementary school. The second section, that dealing with historical geography, has so wide a scope that probably few teachers would undertake to teach it in the short time that can usually be allotted to geography. It views all human history in the light of the influence which geographical conditions have exercised upon man's development. It starts with savage man, goes on to the ancient civilisations of Asia and Egypt, noting that "reasons for priority may be found in the half-desert climate, combined with the abundance of large mammals capable of being brought into the service of man, which favoured pastoral occupations," and compares these civilisations with "the relative advancement found in the half-desert portions of Central and South America on the arrival of Europeans." Next are mentioned the Phœnicians, the Greeks, Rome, Carthage, and the fall of the Roman Empire. Then more modern times follow: "The Teutonic idea of government, why preserved in England, lost on the Continent;" Spanish power, the Rhine and Holland, the downfall of Spain, the rise of French power, the increasing importance of the New World, the spread of European civilisation in all parts of the world. When it is added that the above are only selections from the topics which space forbids quoting more fully, it surely will be agreed that teachers can scarcely hope to complete the scheme of which this historical section is but one-third. Besides the capacity of the children and the scantiness of time, the limits of the teacher's knowledge must be taken into account. A

really successful teacher must know far more of a subject than he attempts to teach, and how many teachers have the opportunity so to master the history of man's development and his relations to his environments as shown in history, that they can generalise and review, compress and illustrate the matter for a class of children?

The third section, "Topographical and Economic," deals with such topics as commerce and the effect of situation upon possibilities of trade, communication and the relation of valleys to trade routes, fisheries, agriculture, the formation of soils and their influence upon human activities.

These schemes, then, are valuable as general guides and are full of suggestions, but they must be used intelligently. The Board express the desire: "Each teacher should think for himself and work out for himself such methods of teaching as may use his powers to the best advantage and be best suited to the particular needs and conditions of the school." If this is done with the aid of these "Suggestions," there can be no doubt that a much-needed improvement in the teaching of geography will result.

A SCHOOL JOURNEY TO ST. ALBANS.

BY R. J. FINCH,

Hornsey Higher Elementary School.

SINCE the Hornsey Higher Elementary School was opened in January 1904, it has been customary for teachers and scholars to make historical and geographical excursions together as part of the school courses.

One of the most interesting school journeys undertaken is that to the historic city of St. Albans. The journey forms part of the First Year Course in History, and is illustrative of those portions of the work dealing with Roman and Roman-British history. But although its interest centres therefore mainly in the Roman antiquities of St. Albans, yet most of the scholars are able to appreciate, from the point of view of previous studies, the other remarkable historical interests of the city. St. Albans teems with historical interest, extending from the earliest periods of British history to the present day.

A whole day is devoted to the excursion, as all the scholars of the first year are included in the party, which this year numbered ninety-one. It will be seen that the organisation of an expedition of this kind requires considerable forethought; all details are definitely arranged at least a week before the date on which the journey is to take place. The Great Northern Railway offer every facility for the rail journey, for, in addition to granting reduced fares, special "through" carriages are attached to the train, and thus the awkward change at Hatfield is avoided. Special advantages attach to a "party ticket," for the date of journey and number of the party can be written in at the moment of starting. Further, if the weather be unsuitable for the expedition, the local stationmaster may be advised of the fact, and all arrangements may be temporarily cancelled until a more suitable day occurs. A preliminary announcement of the journey is posted on the school notice-board well in advance, so that scholars may make all necessary arrangements for the day's absence from home. Each scholar takes lunch with him; tea is prepared at St. Albans by a local caterer. The cost of the journey to each child is as under:—

	s.	d.
Return Railway Fare	0	9
Tea	0	6
Admission to Cathedral . . .	0	1
Total . . .	1	4

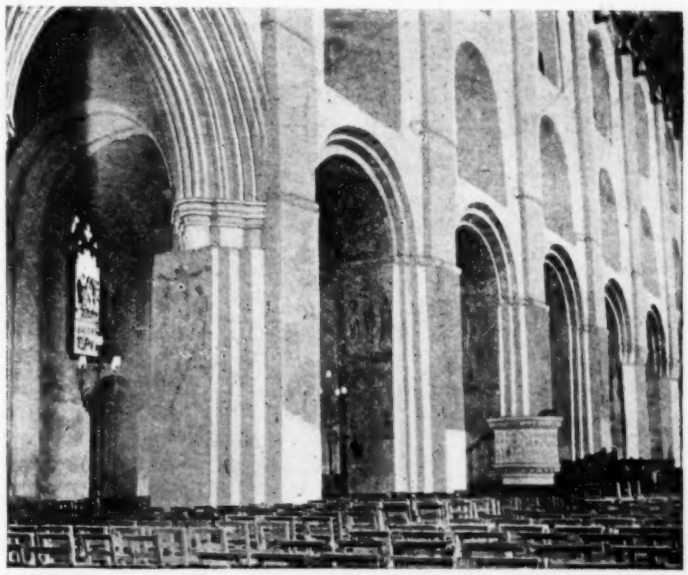
Each class teacher has charge of the financial arrangements of his section, and during the journey exercises a general supervision over the scholars. Permission to visit the Cathedral is obtained from the Very Rev. the Dean of St. Albans, who has taken great interest in these expeditions, and who personally conducts the party when the Cathedral is visited.

Careful preparation for the journey is essential to its success. A very necessary feature of the equipment of each scholar is the cyclostyled "guide," which contains (1) a full map of those parts of the city to be visited; (2) brief notes summarising the chief points of historical interest; (3) detailed plan of the Cathedral. That portion of the map showing the Roman remains is treated with some detail, as their careful study is the main object of the journey. The map is first carefully studied, the route to be taken marked out, and the sites of places of interest duly noted. Special supplementary lessons are given dealing with the early British and Roman history of St. Albans; the story of Roman Verulamium, of the martyrdom of St. Albanus, and of the sack and burning of the city by the vengeful warrior queen of the Iceni is recapitulated; the monastery established by Offa of Mercia is described and its history briefly outlined; the development of the Cathedral from the simple Norman church of monastic times to the splendid edifice of to-day is traced, and its architectural beauties simply explained. The scholars are then conducted on an imaginary journey round the city by the aid of the map, and are told what to look for, and what is worth seeing at each point of interest. In this they are much aided by the study of an excellent series of lantern slides which are used to illustrate the preparatory lessons. Further, scholars who care to do so, may purchase very compact illustrated guides to St. Albans (2d.), which they can read at home. The following is a brief description of our recent journey to St. Albans:—

By 9 A.M. we are safely entrained and on the way to St. Albans. The scholars begin to exercise their powers of observation at once, for their frequent journeys and out-door lessons in geography have accustomed them to the freedom of "school out of doors," so there is no undue exuberance of spirits. The rail journey is occupied mainly in careful observation of the country through which the route lies and points of geographical interest, such as the courses of streams, slope of land, and the situation of villages and farms, are duly noted. Many scholars draw sketch-plans of the railway journey, showing the embankments, cuttings, tunnels, and stations passed. These are afterwards carefully redrawn at home, and compared with the Ordnance maps which the scholars use in their class-lessons.

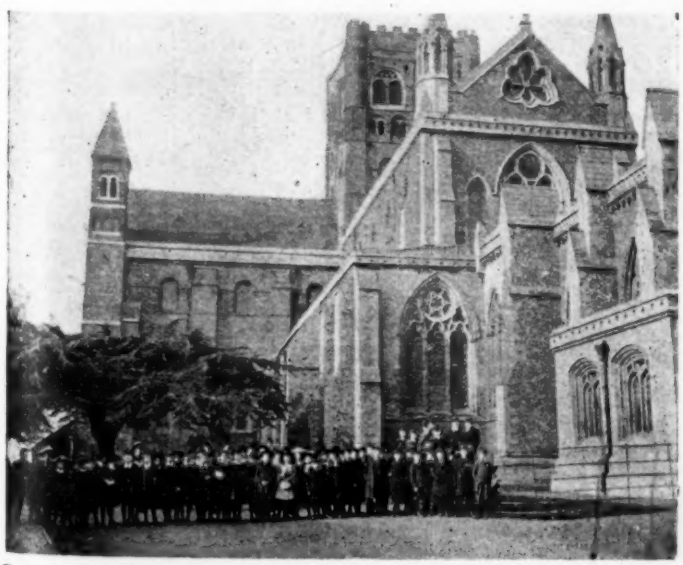
On arriving at St. Albans we wend our way up the London Road, till on the crest of the hill we obtain our first glimpse of the Cathedral. To the right, in the low valley of the Ver, lie the venerable ruins of Sopwell Nunnery, built by Abbot Geoffrey de Gorham.

1140. The story of its origin is related, and the site of the Holy Well, whose water in days gone by wrought miraculous cures, is pointed out to the scholars. Amongst its pilgrims, so tradition has it, was the British prince, Uther Pendragon, who was there healed of a grievous wound which he had received in a fight against the Saxons. Soon the scholars enter the Sumpter Yard of the old Monastery —now part of the Cathedral enclosure— and group themselves under the famous cedar, whose age is variously estimated at from 500 to 1000 years. The attention of all is now fixed on the grand Norman Tower of the Cathedral, and an interesting discussion on its history and architecture follows. The Roman bricks, of which it is largely built, can be plainly seen, and the explanation of their presence there is soon arrived at by the children. They are the bricks of ancient Verulamium, and are at least 2000 years old. The hardness of these bricks is forcibly realised by the scholars when they are reminded that the bricks have weathered the storms of twenty centuries. Cameras are now in great evidence, and some excellent views of the Abbey are taken by the scholars. The Very Rev. Dean Lawrance now joins the party, and leads the way along the south side of the Cathedral, past the remains of the old Cloisters, to the West Door. Inside the children take their seats in the Nave, and are soon listening with absorbed attention to the Dean, whose clear and simple account of the building of the great Cathedral awakens the keenest interest in the minds of his hearers. The memorial painting on one of the pillars on the left of the Nave is



FRESCOES ON THE WALLS IN THE NAVE OF THE CATHEDRAL, SHOWING JUNCTION OF NORMAN AND GOTHIC ARCHITECTURE.

which, like Sir John Mandeville's epitaph, were discovered beneath the whitewash by a former rector of St. Albans, and which are now pointed out as illustrating the original decoration of the early Norman part of the building. The Latin inscription over the West Door is translated, reminding the scholars that here the law courts were held when London was in the grip of the plague. The tombs of Roger and Sigar, the hermits, next attract attention, and the story is told of Sigar, whose pious prayers banished all the nightingales from Northaw Woods because their song interfered with his devotions. The stone coffins opposite are examined with much interest, and the party pass on till they are under the great tower of the Cathedral. Here the beautiful painted ceilings of the Choir and Chancel are plainly visible. In the South Transept attention is called to the Triforium, which here has the Saxon baluster columns used in the church which Offa of Mercia built on this spot in 793. The arches of the gallery have the plaster removed from them to show their construction of Roman tile-bricks from Verulamium. But the North Transept, which, tradition states, is built on the exact spot where Albanus was martyred, is now the centre of interest, and the story of the martyr is again briefly recounted. Passing into the South Transept again, we note the richly ornamented Norman doorway leading into the "Slype" or narrow passage between the walls of the Chapter House and the Transept. Soon we are standing before the great Wallingford Screen, and all are lost in admiration of this grandest work of its kind in the kingdom. The children particularly are interested, for in their school hall hangs a fine photograph of this magnificent High Altar Screen, and now they



GROUP OF SCHOLARS IN THE SUMPTER YARD, UNDER THE ANCIENT TREE.

in memory of Sir John Mandeville, whose fame as traveller and storyteller is recalled. On the Norman arches farther down the Nave are the famous frescoes,

are face to face with its original. The Chantries of Abbot John of Wheathampsted and Abbot Ramryge are next examined, the curious rebus of the latter

ST. ALBAN'S SHRINE AND WATCHING GALLERY.

proving of great interest; then, having viewed the remains of the Shrine of St. Amphibalus, for whose sake St. Alban suffered martyrdom, we pass into the Saint's Chapel, where stands the restored remnant of the Shrine of St. Alban, overlooked by the "Watching Gallery," where in ancient days stood the monk whose watchful eye kept ward over the treasures of the shrine. The splendid chantry tomb of Humphrey, Duke of Gloucester, on the south side of the Chapel, is the next object of interest, and the wooden trapdoor of the vault is raised to allow the scholars to peer into the sacred recess, where lie Humphrey's bones, once the prey of the relic-hunter. Now the scholars turn toward the Lady Chapel, where all remain seated while its story is simply told. Its present beauty is contrasted with its former ruinous condition, barbarously mutilated as it was by generations of schoolboys—for from 1553 to 1870 it was used as a schoolroom by the boys of the Grammar School.

Leaving the Cathedral by the West Door, we pass through the Old Monastery Gate, which gave entrance to the great courtyard. It dates from 1365, and its connection with Wat Tyler's rebellion renders it of remarkable interest. The children are familiar with the story of the siege of the Gateway by the peasants, and at once eagerly look for signs of the gloomy dungeons where John Ball, with seventeen others, spent the last hours before their execution. The teacher now supplies the interesting information that in this very building was set up the third printing press in England (1480). The Gateway was used as a prison as recently as 1868, when it was purchased by the Governors of the Grammar School for use instead of the Lady Chapel.

We now turn down Abbey Mill Lane towards the Ver and Verulamium. On the way our attention is claimed by the celebrated "Round House"—the "oldest inhabited house in England." Its former dignity as the fortified St. Germain's Gateway, and its subterranean connection with the old monastery are referred to, and we pass on by the broad bend of the Ver to the site of Verulamium. The scholars no sooner catch a glimpse of the ancient walls than a general scamper ensues in the endeavour of each to be first there. Soon all are grouped around these relics of a bygone empire, and now comes the realisation of the story of Verulamium. The construction of the walls is carefully studied; the regular layers of flint three feet deep followed by three courses of the hard Roman brickwork are noted, and the general direction of the walls is pointed out. One boy discovers a detached flint which contains an excellent impression of a fossil coral—this is carefully stored away for the school museum. Many are anxious to chip off fragments of the wall as souvenirs, but from this they are deterred by the teacher, who points out the inestimable value of the remains to future generations, and tells how much

IN THE LADY CHAPEL, FORMERLY USED AS THE GRAMMAR SCHOOL.

of the wall has disappeared owing to sheer vandalism, and how, not many years ago, the Roman brickwork was broken up and used to pave the roads. A long

halt is called here, and the scholars, having disposed of the lunch they have brought with them, separate into little groups and talk over all they have seen and heard; maps and guides are more interesting now than ever—and so time passes till the order to proceed is given.

Our route now lies along the line of the city wall. On the right rises the ponderous thickness of the walls, now very much overgrown with trees, but preserved to posterity through the praiseworthy efforts of the local Archæological Society; on the left lies the well-marked "fosse," whose original width and depth are the source of much speculation on the part of the children, who listen with absorbed interest as the teacher restores the walls of Verulamium, peoples them with Roman defenders, and depicts a siege of the city by the war-like tribes of the country round. Proceeding, we soon emerge upon King Harry Lane, and, turning to the left, obtain a fine view of the Cathedral from the south-west. A polite request at a farmhouse on the right secures us permission to enter a field and examine a vast hollow, so regular in outline that antiquarians are certain that it is the site of a Roman amphitheatre. Grouped in the bottom of the hollow the scholars, at the instance of their teacher, see rising around them the tiers of seats, with the throngs of Roman spectators, and witness in imagination the sights of a Roman holiday.

Next we visit St. Stephen's Church, built by Abbot Ulsinus in the tenth century. Here we discover many objects of engrossing interest. In the churchyard lies one of the old "milestones" of Watling Street, which runs by the church, and in the vestry are valuable relics found in the vicinity—terra-cotta vases, lamps, pateræ, cymbia, and a fine glass cinerary urn. The latter is of a most unusual shape, being hexagonal in form, instead of exhibiting the usual square jar-like outline. Here, too, as in most of the famous buildings of the city, we find the Roman brickwork used. The brass eagle lectern has a story to tell. It was formerly in the Abbey Church at Holyrood, but was captured in a raid by Sir Richard Lee, who brought it to St. Stephen's Church.

We now retrace our steps along King Harry Lane, until we arrive at the site of one of the old gates of Verulamium, where Camlet Way, the road from Silchester, entered the city. This is now marked merely by the entrance to a field on the right, through which the scholars gain a glimpse of the fosse and walls as they trend westward, and of a long straight depression said to be the continuation of part of Watling Street. Another fine remnant of the walls is examined on turning down Blue House Hill. Below us lies a field where, buried beneath the soil, lies the Roman theatre in an excellent state of preservation. On being told that it was uncovered some time ago when the locality was visited by the British Archæological Society, many scholars express a wish that they too had been there to see it. At the foot of the hill we turn aside to visit St. Michael's Church, where again the scholars find abundant food for thought and imagination, for it occupies the site of a Roman temple, and in the field bordering the churchyard were unearthed not long ago splendid specimens of tessellated pavement forming part of the Roman Forum. Within the church the chief object of interest is the statue of Sir Francis Bacon, Baron Verulam.

On leaving St. Michael's Church we recross the Ver and proceed up Fishpool Street to the Market Place, noting on the way Romeland, the scene of the burning at the stake of George Tankerfield, 1555, mention of which brings forcibly to the children's minds the horrors of the Marian persecution.

But the day is wearing to a close, and in spite of the attractions of historic places still unvisited—those of the battles of St. Albans and St. Peter's Church—the scholars feel quite ready for their tea, which has been prepared in the Town Hall. So thither we find our way, passing with but scant recognition the Clock Tower, built on the site of the Cross erected to the memory of Queen Eleanor by Edward I. After tea the children troop quietly down to the station, where the train awaits us.

There is great discussion on the journey home; great comparing of notebooks and sketches; and grand summings-up of knotty points which have arisen during the day. Great care is taken of notes and sketches made during the visit, for all are aware that from each will be required a written account of their observations during the expedition. As final revision, the lantern slides are again brought out and examined—this time from quite a different standpoint—and interesting discussions of these are the result. A series of enlarged photographs, too, are arranged in the hall specimen cases to supplement the slides.

It is interesting to note that this year many of the written accounts took the form of letters, which were sent, some to the teachers, some to the headmaster, and not a few to the Dean of St. Albans himself.

REGULATIONS FOR SECONDARY SCHOOLS.

GEOGRAPHY—(*continued from page* 310).

FIRST YEAR.—TERM III.

Europe in Detail.

IN dealing in detail with the continent from which modern civilisation has sprung, whose energetic inhabitants have spread themselves over the globe, and who have conquered the world of commerce, there is a wealth of material for interesting lessons. The syllabus appended is mainly directed to a consideration of the rise and progress of each country, showing what the peoples are doing with their national heritage; the exploitation of natural products; the building up of industries; their trafficking and rivalry with each other; and their national contribution to the progress and civilisation of the world.

Scholars should be led to gather much useful knowledge from a study of the map itself. Mountains suggest minerals, just as grassy plains and rising uplands indicate cattle and sheep. Traffic naturally follows line of least resistance, as along river valleys, from which deduce selection of sites for towns, *e.g.* at a river confluence, where a river suddenly changes its direction; where plain merges into upland or leads to a mountain pass. To natural means of communication add roads, canals, and railways.

Review the country from the commercial aspect, since this will show the degree of the intensity of the national activity, and the possibilities of the national wealth and progress. This will not interfere with the inclusion of historical and social information that give life and interest to the lesson, without which it loses half its value. After obtaining a clear idea of the physical features of the country, and its relation to neighbouring states, discuss:—

1. Climate, soil, and productions.
2. Industrial characteristics of the people. Chief towns engaged.
3. Distributing centres for internal trade.
4. Foreign commerce.
5. How the capital may best be reached from England.
6. British commercial interests in the country.
7. Historical and social facts.

The chief commercial countries of Europe afford great scope for treatment on the above lines, while others will require but brief mention in regard to some of the points. The following notes are only suggestive of some of the directions in which the teacher can leave the beaten track of the stereotyped text-book.

France.—Excellent position, adjacent to busiest states of Europe. Equal advantages with Britain for facility of intercourse with America. Better position still for Mediterranean trade. Each coast receives at least one good navigable river. Good harbours except Bay of Biscay.

Climate, Soil, Productions.—Varying climate in different regions, and the corresponding vegetable products. Normandy damper than inland regions, or the Garonne basin sheltered by the Pyrenees. Orchards and dairying. The dampish heat of the lower Rhone valley—maize, mulberry, olive. Warm plains of the Seine and Loire, warm slopes of Champagne, Burgundy, and Guienne—wheat and vine regions. Garonne and Sarthe valleys for flax. Toulouse region, tobacco. Beet in centre and north. One-sixth country, forest. Charcoal largely instead of coal.

Coal exists in many places, except in extreme north remote from coast. French ports import British coal. Extension of Belgian coalfield into France. Creuzot and St. Etienne mining districts. Iron and coal seldom in conjunction except at two last named. Excellent ore at Nancy, but rock salt instead of fuel.

Industrial Characteristics.—Agriculture employs half the people. Small holdings of land the rule; land divided among children at death of landowner. *Cf.* system in United Kingdom. Note textiles manufactured in different regions irrespective of coal. Linen gravitates to north for coal and nearness to Belgian flax. Delicacy of many French productions; porcelain, gloves, boots and shoes, millinery, etc.

Communications.—Best roads in Europe, chiefly owing to necessity of easy communication with the forests for wood and charcoal. Network of canals. Canal du Midi (Garonne to Mediterranean). Project to enlarge to ship canal; this would "turn" Gibraltar, and rob it of much strategic value. Paris the great railway centre. Trace journeys to surrounding states. Discuss industrial districts *en route*.

Trade and Commerce.—Third in Europe in value, but not increasing, as in United Kingdom and Germany. Wealth of the country, *e.g.*, rapid recovery after Franco-German war. Britain is France's best customer, taking £50,000,000 from her; France takes but £22,000,000 in return. Recent Anglo-French agreement.

Historical, etc.—The Gauls. Relationships with England. William the Conqueror. English kings' claims to France. Unification of the country later than England. Wars with England. Trafalgar. Waterloo. The French Revolution. Franco-German War. The *entente cordiale*.

Belgium.—Smallest country except Montenegro. Absence of elevations. Unequalled position for transit trade between France and north-western countries of Europe, and between England and the Continent. Only 40 miles of sea coast. Mouths of its chief rivers are in Holland—a disadvantage. Little variety of climate; subject to extremes.

Industrial Characteristics.—Essentially a mining and manufacturing country, but three-fifths of soil highly cultivated by the spade. The Campine pastures (drained marsh and heath); Ardennes slopes for sheep. Flanders for horses. Grain, flax, and beet. The Sambre Valley coal and iron towns. Textiles almost entirely remote from coal; atoned for by easy transit. Note remarkable industrial town Seraing. Great ironworks established by an Englishman, John Cockerill, in 1817. The whole town (population 40,000) dependent upon the works; 12,000 employés.

Communications.—Ghent, the centre of the canal system. Trace connections, Brussels and Charleroi; Brussels with Antwerp and Ostend. Campine canal connecting Antwerp with the Rhine. Belgium better railed than any other country in Europe. Trace connections with Paris, towards which Belgian lines converge. London *viâ* Ostend for the Continent.

Trade and Commerce.—Belgium in same category as England; imports food-stuffs; exports manufactured goods. Competes with British iron and steel, rails, etc. Difficult to trace much of her trade, which is only in transit. Annual value with United Kingdom about £33,000,000; secondly with France.

Historical, etc.—Buffer state between France and Europe—the battlefield of Europe. Discuss Steinkirk, Oudenarde, Malplaquet, Quatre Bras, Waterloo. The separation of Holland. Modern tranquillity compared to troublous times when country claimed by Spain, France, and Austria. Neutrality guaranteed by the great Powers. No large standing army; no navy; no colonies except semi-colony, the Congo State. Taxation light. French language.

Holland.—The constant struggle against the sea. Dykes and dunes. Formation of Zuyder and Dollart Zees. 2500 square miles covered by sea since 13th century; 1500 miles reclaimed. The present draining of Zuyder Zee. Note great dyke at West Kappel. Holland largely the delta of Rhine; recent alluvial deposits; no minerals; no fuel except peat. The raised beds of the rivers; their danger to surrounding country.

Industrial Characteristics.—Natural formation of country driving the inhabitants to seafaring, fishing, and agriculture. Herring fishery important in time of William the Conqueror. Rich pastures; more cattle than in British Isles. Enormous dairying industry. Rye the chief grain; large demand for distilling Hollands gin. Schiedam alone 200 distilleries. Flax largely grown, but chiefly for Belgian factories, though

brown "Holland" is made at Haarlem and Tilberg. Chicory and mustard, important crops. Flower bulbs. Delft pottery. Shipbuilding at Rotterdam important, though all coal and iron have to be imported; second only to Germany in shipbuilding output. Diamond cutting at Amsterdam.

Trade and Commerce.—Great emporium for eastern colonial produce. The Dutch East Indies the spicery of the world. Great transit trade with Germany and Switzerland to and from the North Sea. Ship canals to facilitate trade: North Holland Canal; the North Sea Canal; another from Rotterdam to a point on coast a little north of the Hook. Netherlands trade returns deceptive; iron and steel to value of a million figure in the exports, in transit from Germany. Dutch butter (1½ millions), margarine nearly twice as much, cheese, condensed milk are exported to England. The Dutch are good customers to England, taking £3 per head. *Cf.* Germany, 16s.; and France, 13s. 6d.

Historical, etc.—Early connection with Spain, France, and Austria. Naval wars with England. Dutch maritime supremacy; her eastern possessions. Defeat of Spanish Armada stimulated trade. New York colonised by Dutch. Less poverty than any other country. Cheap administration. Germany's desire to possess Holland to give her North Sea coast for her growing commerce.

Germany.—The disadvantages of the coast. Country best viewed from point of river basins. River currents slow, and useful for navigation, but embouch on coast hampered by "haffs" and ice for several months in the year.

Climate, Soil, and Productions.—Bleak in north; dry in centre; warm in south, except Silesia, where elevation makes it colder. Rhine Valley, warm and genial. Berlin, winter traffic by sledge. One-fourth country forests; no extensive wastes. Great mineral wealth. Germany second in European coal output, 103,000,000 tons. *Cf.* United States (316,000,000), and United Kingdom (166,532,000). Point out chief coalfields as centre of industries. Other useful metals and minerals.

Industrial Characteristics.—Agriculture the chief employment, but industrial regions growing rapidly. The chief crops. Beet sugar industry. Horses, cattle, and sheep in great numbers. Saxony wool. Westphalian hams. Pomeranian geese. Metals and textiles, chiefly in Prussia and Saxony. Wine in Rhine valley, hock and moselle. Beer in Bavaria. Musical instruments, toys, paper, and printing. Bavarian glass. Note Krupp's works at Essen for ordnance, armour plate, rails, etc.; 20,000 hands.

German Rivalry with Britain.—Germany's amazing industrial progress in recent years. Pig iron a good basis for comparison.

	1884	1903
British output	7¾ million tons	9 million tons
German ,,	3½ ,, ,,	10 ,, ,,

German hardware imported into Britain in increasing quantities.

In *shipbuilding* Germany is next to Britain, though her output, 31,000 tons, small compared with Britain's 9,000,000 tons in 1903. Workmen in all industries poorly paid compared with England.

Communications.—7000 miles of navigable rivers, 2000 miles of canals, and 32,000 miles of railways, speak volumes for facility. Good connection with S. Europe *viâ* Swiss lines and Alpine tunnels. Trace routes. Baltic Ship Canal.

Trade and Commerce.—Though it has expanded by leaps and bounds, it is yet but £6 per head of population. *Cf.* Britain's £23 per head. Germany's efforts to obtain colonies in Africa and Oceania. She imports into Great Britain goods to the value of £30,000,000, taking in return nearly the same value. Germany's great steamship lines, especially North-German Lloyd and Hamburg-American lines. The latter the largest shipping concern in the world, with 125 vessels of 650,000 tons. *Cf.* Cunard Line, 21 vessels of 170,000 tons. German s.s. *Deutschland* holds the Atlantic record, 2982 miles in 5 days 7½ hours. Great German liners built for mails and passengers only. Little cargo capacity and enormous coal consumption make them unprofitable, and little effect on the carrying trade.

Historical, etc.—Empire founded by union of twenty smaller kingdoms. Unification not completed until Franco-German War, 1870–71. Give particulars of the struggle. Bismarck and Moltke. Siege and occupation of Paris. The restless energy of Kaiser Wilhelm. Conscription as in other European countries. *Cf.* Britain's voluntary army. German educational system, 99 per cent. of people can read and write. *Cf.* Russia, three-fifths illiterate.

Norway and Sweden.—The Fiords. Maelstrom. Lofoden Isles. Immense broken tableland from north to south; its steep slope to the Atlantic; the terraces (forest, mines, and agriculture) to the Baltic. Norwegian rivers useless for navigation, but immense water power available. Swedish rivers longer, and greater utility for commerce.

Climate, Soil, and Productions.—Warm western coast considering latitude. Discuss effect of Gulf Stream. Swedish climate more continental. The frozen Baltic. Copious rainfall. Soil chiefly mountain detritus. Only 4 per cent. of Norway under crops; 12 per cent. in Sweden. Norwegian wealth depends upon fisheries, forests, and cattle; Sweden, forests, minerals, and cattle. The forest products; timber, tar, pitch, potash, turpentine. Describe production of each. The wood pulp trade. Barley succeeds to 70°. Black rye bread and potatoes the staple food. The great cod fisheries of Lofoden Isles supply Roman Catholic countries in south of Europe; feathers. Swedish iron ores (especially Dannemora region), Gellivara ore not so good. Fahlun for copper.

Industrial Characteristics. — Neither country can become industrially great owing to lack of coal. Iron-smelting by charcoal. Coarse woollens manufactured for home markets. Enormous production of butter. The sulphur of Gothenburg and pine wood give rise to match manufacture.

Communications and Commerce.—Good roads and railways. Few inland towns of importance. Trace route Gothenburg to Stockholm, thence along Gulf of Bothnia, Dannemora, Gefle, Lulea, and then across peninsula *viâ* Gellivara to Tromsöe. Gotha steamship canal connects the Swedish lakes with the Baltic and North Seas, particularly serving the Lake Wener iron region. Of the total foreign trade one-third with the United Kingdom, which takes forest products alone to value of 8 millions; butter 1¼ millions: fish, matches, condensed milk, etc.

Historical, etc.—In early days Norway, Sweden, and Denmark closely allied; different branches of the same

race. Rolf the Ganger, ancestor of William the Conqueror. Union of Norway and Sweden. Recent separation. Prince Charles of Denmark and Princess Maud of Wales elected King and Queen of Norway.

Denmark.—With land boundary of only fifty miles, practically an island kingdom. Note commercial and strategic importance, commanding entrance to Baltic. North Sea coast resembles Holland; Lym Fiord formed by inundation of sea. Good harbours on Baltic. The dangerous passages Scager Rack and Cattegat. Iceland. Faroe Islands.

Climate, Soil, and Productions.—Flat surface; no mountains, rivers, lakes, or forests of importance. Insular and foggy, Denmark is colder than England. Sandy soil rendered fertile by careful spade cultivation. *Cf.* Belgium. Excellent pasture land, especially S.W. Jutland. Oats and barley cultivated, but dairying and poultry rearing very highly developed. Few manufactures: gloves and porcelain the chief. Peasant proprietorship, 150,000 farms of only 7 to 10 acres; 76,000 of 100 acres and over. Produce of small farms collected at common centres by a system of co-operation. Systematic dairy farming has raised Denmark from a poverty-stricken country to relatively one of the richest. National wealth of Denmark per head, £230. *Cf.* United Kingdom £247, France £224, Holland £216. Under a similar land system Britain could produce twice the amount of grain and fruit that is now yielded. Discuss the unemployed in large towns of Britain, and "back to the land."

Commerce.—Imports and exports increasing. United Kingdom takes butter (8 million pounds), bacon 3 millions, and eggs 1 million pounds' worth. Denmark imports coal, iron, and textiles.

Historical, etc.—Hengist and Horsa. Danish dynasty in England. Charles II. of Sweden crossed ice and besieged Copenhagen, 1669. Nelson and Danish fleet, 1801. Bombardment of the capital by British in 1807. Ruling house of Denmark and its relationships to other ruling houses of Europe. *Cf.* Queen Alexandra, Czarina, King Haakon (Prince Charles of Denmark) of Norway.

Russia.—Half area of Europe. No direct outlet to ocean except *viâ* the frozen north. Russia's great desire for a port on the Mediterranean or North Seas. The White, Baltic, and Black Seas are inland, and subject to disadvantages in climate, as well as remoteness from the busiest shipping thoroughfares.

Climate, Soil, and Productions.—Owing to distance from sea, climate not so varied as great size would suggest. Summers warmer, winters colder than corresponding latitudes. Snow falls 70 days in St. Petersburg. The country's great natural wealth. Forests. The Black lands. The wheat output—the people eat rye. The Steppes. Tundras. Southern fruit-belt. Minerals. The petroleum fields of Baku. Vast coalfields (Donetz basin; Vistula, near Lodz; Tula; Perm).

Industrial Characteristics.—Manufactures backward, but improving in recent years, largely by means of foreign capital. Cottons and woollens almost sufficient for home needs. Linen, a great peasant industry. Iron and steel output steadily increasing. Spirit distilling very important. Spirit drinking (vodka) a national curse.

Communications.—50,000 miles of navigable rivers, one-third of which navigable for steamers, and the remainder for small vessels and rafts. Canals link up rivers: Black and Baltic connected *viâ* Beresina Canal and rivers Dnieper and W. Dwina; by Oginski Canal and rivers Dnieper and Niemen; and King's Canal and Dnieper and Bug. The Caspian and Baltic are connected by the Neva and Volga and the Maria and Volotshok Canals. Though there are 40,000 miles of railways, there are vast regions yet unserved. Archangel now railed *via* Viatka and Perm to join the Great Siberian Railway. Discuss the line St. Petersburg to the Pacific. Note southern connections *via* Tsaritsin to Nova-Rossusk on Black Sea.

Commerce.—Two-sided. On west exports her agricultural and forest products in return for manufactured goods; on the east imports raw materials in return for her own manufactures into Asia. Fairs are of greater importance than in any other country. Nijni Novgorod fair transacts £18,000,000 trade in three months; Siberian railway will affect adversely. Kharkov and Kiev important fairs. Russia exports to Britain timber, wheat, flax, eggs, petroleum, butter, etc., to value of over £20,000,000. She takes iron, coal, machinery, etc., to about half the value. Much Russian grain and dairy produce now comes from Siberia.

Historical, etc.—Modern Russia dates from Peter the Great, until whose reign she possessed no sea border at all. The ever-extending boundaries in search of open ports. Russia and the Poles. The Crimean War. Abolition of serfdom, 1861. War with Turkey. Finland troubles. The Russo-Japanese War. Present condition of the country. Autocratic government. Power of the nobility. No middle classes, such as obtained political freedom for the British.

Austria-Hungary.—Great length of frontier. Mountains everywhere barriers to easy intercourse with neighbouring states. The Danube the key to the whole country, the great natural commercial highway, but it leads to the inactive centres of Europe, rather than the progressive centres of the West. Short length of sea-coast, and this remote.

Climate, Soil, and Productions.—Mountains not high enough to protect from cold winds from Russia or hot winds from Africa. Distance from sea prevents large rainfall. Climate almost entirely continental. Soil fertile, especially in the Banat and Galicia. Pusstas of Northern Hungary. Karst region almost desert; destruction of forests exposed it to the icy *Bora* from the Adriatic. Forest regions. Pastoral pursuits. Agriculture. Silkworm. Plain of Hungary for wheat and maize. Dry climate favourable to great egg trade. Great mineral wealth, but coal and iron rarely in conjunction. Wieliczka salt mines. Gold and silver.

Industrial Characteristics.—Note textiles of Bohemia, Moravia, and Silesia; metal goods of Upper Austria (Steyr), valley of Mur (Gratz), and Carinthia (Klagenfurt). Bohemian glass. Vienna, silk and articles of vertu.

Commerce.—23,000 miles railways. Lines over Bremner and Semmering Passes. Arlberg Tunnel. Trace routes to neighbouring states, *e.g.* to St. Petersburg, Berlin, and Paris. A canal from a tributary of the Danube connects with a tributary of the Elbe, affording water communication with Germany. Five-sixths of the trade is overland, chiefly *viâ* Germany. Annual value about £123,000,000. Not being a maritime country, little direct trade with United Kingdom. Wheaten flour from Hungary is the chief export to Britain.

Historical, etc.—Until 1866 Austria was the head of the German confederated States. Austerlitz, 1805. Austria and Prussia went to war, 1866, over the an-

nexation of Schleswig-Holstein. Four great races, with marked characteristics. Twenty languages. Separate interests cause constant turmoil. Education system difficult to compass. Treaty of Berlin, 1878, gave Bosnia-Herzegovina to Austria after Russo-Turkish War.

Switzerland.—Build of country requires special attention. The great Passes (Great St. Bernard, Simplon, St. Gothard, Splugen, Maloggia, and Arlberg), Lakes Geneva and Constance, and the Rhine afford access to surrounding countries in spite of natural isolation. The chief valleys.

Climate, Soil, and Productions.—Cold, but healthy. Great heat in valleys in summer. The *Fohn*, hot, dry, enervating wind, melts the snow in spring. Two-thirds of the country mountainous. Soil fertile in the valleys. Pastures to the snow-line. Minerals unimportant. Note Asphalt in Val de Travers Valley. Grain crops insufficient for needs of country.

Industrial Characteristics.—Immense water-power renders the Swiss largely independent of coal and iron. Manufactures limited to those not requiring great amount of raw material. Cotton industry important; exports more cotton than France.

Commerce.—Note how Swiss railways assist communications of France, Germany, Austria, and Italy. Trace routes to each. Great transit trade. Watches, clocks, silk, cheese, and condensed milk the chief exports to Britain. Germany her best customer.

Historical, etc.—For five centuries Swiss maintained their independence against great neighbouring states. Morgarten and Sempach, famous victories over Austrians. William Tell, the great patriot. Three-fifths of the people Protestant. Calvin. No Swiss language—French, German, and Italian, according to nearness to those countries. Efficient educational system. Playground of Europe.

Spain and Portugal.—Compact peninsula. Great length of seaboard, but dangerous currents in the Atlantic—famous wrecks, as the *Utopia*. Poor harbours except Lisbon and Barcelona. Great central plateau crossed by parallel ridges. Communication between valley and valley difficult. Rivers, rapid; subject to drought and flood.

Climate, Soil, and Productions.—"Africa in Europe." Great extremes in centre; Portugal more equable. Soil in Spain requires irrigation; portions of central plateau, arid; Portugal more fertile. Small area of forest land, especially in Spain. Cork oak. Esparto grass. Wine, fruit, and oil. Semi-tropical products of the south. Agricultural methods backward. Spanish minerals important, especially iron of the north (Bilbao). Almaden silver. Rio Tinto copper. Lead production, half that of Europe.

Industries and Commerce.—Scarcity of coal hampers manufactures, which are depressed but improving. The great wine industry. Fruit trade. Arms, gunpowder, and tobacco, government monopolies. Commerce chiefly in hands of foreigners. *Cf.* former maritime importance. Great Britain the best customer of both countries for wine and fruit, and the iron of Spain for South Wales smelters.

Historical, etc.—The Moors in Spain, eighth to fifteenth centuries. The former greatness of both countries. The great Portuguese navigators. Early interests in America. Spanish Armada. Napoleon and Spain. Peninsular War. American and Spanish War. Spanish and Portuguese foreign possessions. Superstition and ignorance of the people. Backward state of education. Gibraltar.

Italy.—Continental, peninsular, and insular. The Alpine frontier. Length of country difficult to administer from a single centre. Differences in characteristics of various regions cause different habits and interests of the peoples.

Climate, Soil, and Productions.—Plain of Lombardy as wet as Ireland, but Italy on the whole, warm, dry, and delightful. South of Naples, almost tropical. Continental area consists of rich alluvial soil. Rising bed of the river Po. Easy irrigation. Steady advance of the Delta; towns once seaports now twenty miles inland. Portions of the peninsula very unhealthy, *e.g.* Maremma, Campagna, and Pontine Marshes. Eucalypti planting to counteract malaria. The Sirocco. Silk, wine, fruit, and oil. Rice in Po valley. Cotton in extreme south. Sulphur the chief mineral. Carrara marble. Elba iron. Tuscany for boracic acid.

Communications and Commerce.—Absence of navigable rivers makes railways of special importance. Milan and Turin, the great railway centres. Effect of Alpine tunnels, *e.g.* Genoa's rising importance. Brindisi and the Overland Route to India. France takes most of Italy's raw silk. Chief exports to Great Britain, vegetable products, silk, straw-plait, sulphur, marble. Return cargoes, coal, lentils, chemicals, and fish.

Historical, etc.—Ancient Roman Empire. Invasion of Vandals and Goths. Annexation by Charlemagne, 772. Venetia and Lombardy added to German Empire, 1713. Restored to Italy, 1859–1866. Union of rival Italian States under Victor Emanuel, 1866. Garibaldi. The Roman Catholic Church. The Vatican. Italians famous in the fine arts. Famous picture galleries. Historic buildings. Herculaneum and Pompeii.

Balkan Peninsula.—Advantageous commercial situation. The broken coast-line and islands of the south. The high central table-land. The land boundaries; their political and military importance.

Climate, Soil, and Productions.—Elevated regions subject to extremes. Arctic winters and tropical summers. Shores of Ægean Sea balmy and subtropical. Soil exceedingly fertile. Vegetable products rich and varied. Great forests. Olive, orange, lemon, mulberry, and fig in the warm valleys. Rose cultivation for "attar of roses" especially in Kazanlik district. Notwithstanding rude cultivation, more grain grown than for needs of people. Minerals abundant, but little worked; foreign capitalists hesitate to invest in a region of such unsettled government. Manufactures almost absent except a little silk and cotton, leather, tobacco, meerschaum pipes, carpets, and perfumes.

Communications and Commerce.—Roads bad. Railways extending. Trace route, London to Constantinople. Proposed extension across Asia Minor to Persian Gulf. Exports natural productions; imports, textiles, coal, iron, coffee, sugar, etc.

Historical, etc.—Turks are Asiatics who established themselves in Armenia, A.D. 800. Gradually extended dominions; conquered Constantinople, 1453. Besieged Vienna, 1529 and 1683. Defeated by the Poles under Sobieski. Independence of Greece acknowledged, 1830. Separation of Servia, Roumania, Bosnia-Herzegovina, Montenegro, and Bulgaria. Describe each State. The "Sick Man of the East." Dardanelles and passage of war vessels. Russia's desire for Constantinople.

Greece.—Agricultural pursuits of the people. Currant vine. Sponge fisheries of the Archipelago. No manufactures of importance.

Historical, etc.—Glory of ancient Greece. Thermopylæ Pass, 480 B.C. Cæsar and Pompey.

Modern Greece dates from 1830, when it was wrested from Turkey, and its independence guaranteed by England, France, and Russia. In 1863 National Assembly invited second son of King of Denmark to become king. *Cf.* Norway and Prince Charles.

AIDS TO INFORMATION.—Though the *Instructions* deprecates the use of text-books, at least in the earlier stages, teachers will find the volume on Europe in each of the series, "The World and its People," and "The World at Home," particularly useful to scholars. For the teacher's own shelf are recommended *The Making of Europe* (Nelson and Sons), *This World of Ours* (Cassell and Co.), *Man and his Markets* (Macmillan), *Man and his Work* (A. and C. Black), *Man on the Earth* (Blackie). For up-to-date facts and figures concerning the industrial activities of countries, *The Statesman's Year Book* is incomparable. An excellent aid to geographical knowledge is to encourage scholars to collect geographical information from newspapers and magazines, which are months and often years ahead of text-books.

THE CARE OF THE SCHOOL MUSEUM.

BY P. HORN.

MOST schools have their museum, usually a glass-fronted cupboard in the central hall, stocked with specimens contributed chiefly by scholars. The average school museum is conspicuous by reason of the variety of its exhibits, but here and there, amidst the miscellaneous assortment, may be found specimens which are of real practical value for the purpose of demonstrating lessons. Unfortunately, those which evoke the most interest, the things illustrative of living creatures, such as stuffed birds, reptiles, and mounted insects, are peculiarly liable to deterioration.

We can reasonably expect colours to fade to a certain extent, but it is annoying to find a serviceable stuffed bird shedding its feathers through some mysterious agency.

The wisdom of the "stitch in time" is proverbial. All museum specimens, whether they appertain to schools or otherwise, should be periodically overhauled.

Birds.—Furred and feathered creatures require cleaning and touching up, at least once a year, especially if they are constantly handled.

The cleansing medium is benzoline, obtainable at any neighbouring oil-shop. Half a pint of this liquid, together with cotton-wool, a needle, and a camel-hair brush, will suffice for a small collection of birds. Should there be any white-plumaged birds, a packet of coarse plaster of Paris is furthermore needed.

Benzoline is highly inflammable, and should be used a small quantity at a time.

First brush and blow all the dust from the bird, then, with a piece of wadding which has been dipped in benzoline, lightly wipe down the plumage from head to tail, taking care not to saturate. Next take a large piece of dry clean cotton-wool, again wipe down, omitting the benzoline, and stand the specimen aside until the feathers approach to dryness.

The operator need not be discouraged if this treatment apparently causes the bird to appear worse than it was before.

When dry or nearly so, take a long needle, and beginning at the tail, lift the feathers in bunches working upwards from side to side towards the head, and blowing here and there. The object of this proceeding is to loosen and separate the feathers, which have become slightly matted by the liquid. When this operation has been successfully accomplished, and it is by no means difficult, the bird will have gained its former symmetrical appearance, save for a rough surface here and there where the feathers are disarranged. This can easily be rectified by means of the needle and camel-hair brush. After the feathers have been put in order, a distinct improvement will be noticed.

A similar course of treatment will benefit the smaller stuffed mammals. In the case of white-plumaged birds, especially sea-fowl, which are liable to develop dark greasy patches on the breast feathers, owing to the presence of fat which should have been removed in the first instance, more drastic measures must be taken, preferably in the open air. Plaster of Paris, as well as benzoline, is to be used. Place the bird over a shallow tray or sheet of newspaper (in order that no plaster is subsequently lost), and proceed to apply the benzoline as before, but more liberally. The liquid works into the plumage, and sets free the grease, and also carbon products such as soot, thus preparing the way for the plaster, which is an absorbent.

When the bird is thoroughly moistened, sprinkle the plaster thickly over every part of the plumage. In a short time it cakes, owing to saturation. Remove the damp powder and replace with fresh. Allow this to stand for about five minutes, then remove as before.

To dry the feathers and remove the remaining dirt, sprinkle on fresh dry plaster, holding the bird in various positions, and raising the body feathers here and there, so that the absorbent powder can thoroughly penetrate amongst the plumage.

By alternately sprinkling, loosening and shaking the feathers, they will ultimately become dry and clean.

When thoroughly dry, the remaining plaster can be either tapped or blown out of the feathers with a pair of bellows, so as to leave the plumage in a fit state for rearrangement with brush and needle as before.

The process is decidedly unpleasant, and requires a good deal of confidence on the novice's part, but the time is well spent, and a smoke-begrimed old gull or albatross will be hardly recognisable after a course of plaster and benzoline. Recently, when cleaning an extremely dirty penguin, apparently a hopeless case, good results were obtained by vigorously rubbing the offending grease marks with wadding, dipped alternately into plaster and benzoline, so as to form a scouring paste. These were extreme measures, however.

The appearance of a specimen bird or mammal is greatly enhanced if the eyes are bright and in good condition. Cracked eyes should be removed after damping the eyelids, and replaced with sound ones, by means of damp clay.

Eyes which have become dull will look more life-like if they are brushed with a dry tooth-brush and polished with a piece of cloth.

The black stands upon which the birds are mounted often become shabby. In this instance Brunswick black slightly thinned with turpentine can be confidently recommended.

Moths, in the larval stage, are often a nuisance in neglected museums.

They usually advertise their presence by covering the stands with minute droppings and pieces of feather webbing. One species eats away the bottom of the quills so that the feathers fall off at the least touch. I believe the bacon beetle (*Dermestes lardarius*), which is not likely to appear in the school museum, is addicted to a similar practice.

When the specimens affected are in very bad condition, it is the best policy to burn them. Those which have not reached a hopeless stage should have the plumage thoroughly drenched with benzoline, in order to kill any larvæ or eggs which may be present.

Nothing short of benzoline or cyanide of potassium will actually kill these pests, but the adult insects which originate the mischief may be deterred from entering the cases by placing a few pieces of albo-carbon or naphthaline on each shelf.

Spirit Specimens.—Specimens mounted wet, *i.e.* in spirits of wine or other preserving liquid, require to be periodically examined.

As often as not the various snakes and reptiles are mounted very roughly, probably in crude brown ship's rum, if brought from abroad.

Others, originally mounted at home, have discoloured the surrounding spirit owing to too great a haste on the part of the operator.

Whenever the liquid becomes tinged, the specimen should be removed, rinsed, or better still, *soaked* for a time in clean spirit, and remounted in fresh alcohol. Good unadulterated methylated spirit is a satisfactory medium.

Evaporation, primarily caused by imperfect sealing, is another fruitful source of annoyance. Unperceived, the liquid in the vessels sinks lower and lower, until a portion of the specimen is uncovered.

As a consequence, the exposed extremity shrivels, and ultimately decomposition may set in.

Glass-stoppered bottles are usually exempt from this failing; if they are not, a smear of vaseline applied to the stopper previously to insertion, will rectify matters.

When excessive evaporation occurs, as it commonly does in the case of corked vessels, it is best to remount the specimen in fresh alcohol, and use a new cork. Raw cork alone is porous, and will not retain the elusive spirit unless coated with an impervious luting. Sealing-wax, though often tried, is useless. French asphalt, applied hot to the upper surface and sides of the stopper, is said to answer admirably.

Good results have been obtained at the Stepney Museum by using a thin solution of Scotch glue, to which three or four drops of glycerine have been added.

This is applied hot to the sides and upper surface of the cork, and a second coat is added after insertion. Under the influence of the spirit the glue hardens to the consistency of leather.

Similarly, this mixture can be used for sealing the ground glass slips on the top of gas jars when these vessels are utilised for spirit specimens, only in this case the glass cover must be slightly heated before it is placed in position.

Insects.—Most collectors will agree that mounted insects require attention now and again. They are liable to the attacks of a tiny little insect, which appears to derive great nourishment from the dried wings of moths and butterflies.

When the wings present a bitten appearance at the edges, and a brownish dust continually falls on the paper beneath, the presence of these pests is to be suspected. They run with agility, and delight to lurk in corners. I have found them on the setting-boards, hidden beneath the covering of paper.

Benzoline is again the best cure.

Each insect is dipped separately in a saucer of liquid, and pinned on a sheet of cork until dry. In the meanwhile a large piece of cotton-wool saturated in the ever-useful fluid, should be placed in the store box or cabinet, and the lid lightly closed, so that the fumes have an opportunity to penetrate the corners. It is not advisable to dip large "fluffy" moths, such as Eggars; they are best left in the store box with the saturated wadding.

Infested setting-boards may be cured by washing with benzoline.

Mounted insects occasionally work loose on the pins. In such a case a touch of liquid glue or seccotine on the pin beneath, at the point where it enters the body, will stop the rotatory movement.

Refixing in the cabinet may be necessary when the pins come out.

The insects tumble about on the floor of the case, and soon lose portions of their legs and antennæ. A steady hand and a pair of tweezers are now required, together with the seccotine, for the purpose of refixing the legs, etc.

Finally, little muslin bags containing albo-carbon, pinned in each corner of the cabinet, will render the atmosphere unpalatable to the destroying mites.

Shells, etc.—Small shells, such as helix and planorbis, show to advantage when fixed on a common card by means of seccotine: similarly with the smaller fossils, which in some school museums are allowed to lie at random on the shelves. Every school should have a collection of land and fresh-water shells so mounted; they are easily procured by the scholars.

Probably the larger shells, such as the Bear's paw and Scorpion, have become grimy through neglect. They can be restored by means of soap and water. A tooth-brush is handy for the purpose of removing dirt from the sutures and crevices of the larger gasteropods, and all shells should be thoroughly rinsed and dried preparatory to replacement.

Mildew, which sometimes occurs on the bills of birds, and also on fleshy specimens, such as dried starfish and sea cucumbers, is caused by dampness, and can be successfully removed with the aid of a camel-hair brush and benzoline.

A small vessel half full of strong sulphuric acid, placed in an obscure corner of the cabinet, will prevent a repetition of mildew, by keeping the atmosphere dry.

The instructions given above are brief and simple, and, let us hope, acceptable.

Foreign and Colonial Correspondence.—In many schools the system of international correspondence has been taken up, and has been productive of much good.

We understand that owing to numerous applications being received, Messrs. J. S. Fry & Sons, Ltd., of Bristol, are sending out packets of their Pictorial Post Cards to a large number of schools.

COURSE OF LESSONS IN DOMESTIC SCIENCE.

Class.—The upper standards of either urban or rural schools. Most of the lessons in this course are suitable for boys as well as girls, but those dealing with the preparation of food, etc., may be omitted with boys.

Time.—The subject will be dealt with under heads, most of which will require more than one lesson to deal with fully; each month sufficient matter will be given to supply material for four lessons (one each week) of about thirty or forty minutes each.

Object.—Many severe and even fatal diseases have arisen from neglect of some of the most elementary principles of hygiene, and since prevention is better than cure, it is now generally recognised that Domestic Science should find a place in the curriculum of every school, in order to provide the children with some knowledge of the principal laws of health.

SECTION I.—RESPIRATION.

"Of all the things necessary to the preservation of health, pure air is the most important; it is the free gift of God, and yet how many, either from ignorance or sloth, refuse to avail themselves of it."

Step I. Preparation.—Since life is maintained by chemical action that goes on in the system, it is essential that the children should have some slight knowledge of chemistry. The first lesson should therefore be a preparatory one, dealing with elements and compounds and the nature of chemical action. If we take up a dictionary, we find in it thousands of words which are totally different to one another, and yet we form all these words by means of twenty-six letters; no matter how long a word may be, it can be divided first into syllables and finally into letters, which is the limit of the breaking-up process. Similarly, when we look around us, we see thousands of substances—water, chalk, sugar, etc.—which are totally different from each other; but the chemist is able to break these up just as we break up words, and he tells us that, just as all words are only different combinations of letters, so all the substances in the world are made up by different combinations of about seventy simple substances, called *elements*. The substance formed by the union of two or more elements is called a *compound*. The decomposition of a compound into elements can be shown by heating mercuric oxide in a glass tube; a glowing splint will test the presence of oxygen, while the mercury may be seen deposited on the cool parts of the tube. The formation of a compound by the union of two elements may be seen in the rusting of iron, or may be shown by burning sodium in chlorine. Chemical action may take place between compounds, and this is of a more complex nature than the simple union of elements.

man orange house also	=	anomalous hose anger

The words on the right are quite different to those on the left, and yet they are formed by breaking up the words on the left into letters and rearranging them. Similarly, we may take two or more compounds and by chemical action split them up into their component elements, which then rearrange themselves to form new compounds—

Hydrochloric Acid (Hydrogen and Chlorine) Caustic Soda (Hydrogen, Oxygen, Sodium)	=	Common Salt (Sodium and Chlorine) Water (2 Hydrogen and Oxygen)

This is a good example of chemical action. Take a little dilute hydrochloric acid and a solution of caustic soda, and let the children examine their properties—the sharp taste of the one and the soapy feeling when the other is rubbed between the thumb and finger, also the effect of each on litmus. By putting these together in the right proportions—that is, by adding one to the other until it neither turns red litmus blue nor blue red—these properties disappear, and we have simply common salt and water, which may be recognised by its taste or by evaporating the water. The chief points to be noted in connection with chemical action are—

1. Matter is not destroyed during the process, but simply broken up and reformed.

2. The result is the formation of totally different substances.

3. More or less heat is generated. (This may be illustrated by the action of dilute sulphuric acid on zinc.)

The chief elements with which we are concerned at present are oxygen and nitrogen. These are mixed together (not combined) in the proportion of about 1 to 4 to form the atmosphere.

Oxygen can be prepared in small quantities by heating mercuric oxide, or in larger quantities by heating a mixture of potassium chlorate and manganese dioxide. If several jars are prepared, various substances can be burnt, and in every case it will be seen that combustion is much more active in oxygen than in air, and things, such as iron wire, that will not burn in air, burn readily in oxygen.

Nitrogen may be prepared by burning phosphorus in a bell jar; the phosphorus combines with the oxygen, and the nitrogen is left. This can be shown to be a very inert gas, its only use in the atmosphere being to dilute the oxygen.

Carbonic acid gas should be prepared by pouring hydrochloric acid on marble; the latter should be placed in a Woulffe's bottle and covered with water, and the acid poured slowly down the thistle-funnel.

The density of CO_2 should be shown by pouring it from one jar to another; it should also be passed through lime-water to show that it renders the latter turbid.

Step II. Presentation.—1. Take a small bell jar, standing in a trough of water, and show that the air in it is quite normal by putting in a lighted taper, which will still continue to burn. Close the top with a cork, through which passes a glass tube, and remove the air by inhaling it (the rising of the water in the bell jar will show the removal of the air), and then refill with expired air. If a taper is now placed in the jar it will no longer burn, showing that there is less oxygen than before.

2. Breathe into lime-water; after a little while the latter becomes turbid, showing the presence of carbonic acid gas.

3. Breathe on a cold mirror; the surface becomes clouded, showing the presence of moisture.

4. Breathe through a solution of permanganate of potash (Condy's Fluid); the decoloration of the latter betrays the presence of organic matter.

Step III. Association.—From these experiments it is evident that, during the act of respiration, the air loses part of its oxygen, but gains carbonic acid gas, watery vapour, and organic impurities.

The Respiratory Apparatus consists of the lungs and air-pipes leading into them. The first of these into

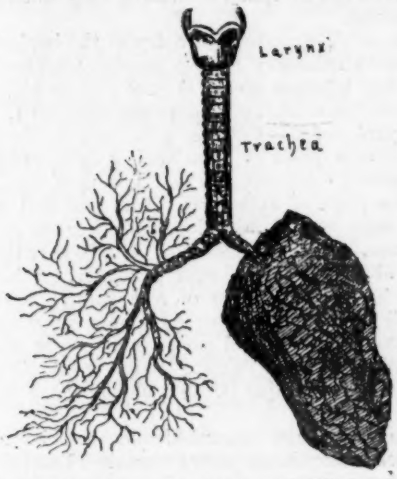


DIAGRAM OF LUNGS & AIR TUBES.

which the air enters is the trachea or windpipe; this divides into two branches called bronchi, which divide and sub-divide into a vast number of small tubes—the bronchial tubes—each of which terminates in a number of pouch-like air-cells. As it is necessary that these passages should not collapse and so cut off the supply of air, they are strengthened by rings of cartilage. Each of the air-cells is covered with a network of fine

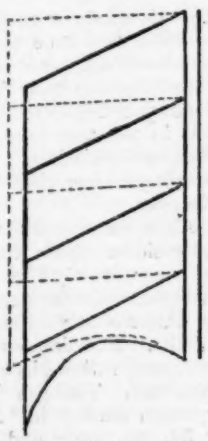


DIAGRAM SHOWING ACTION OF RIBS AND DIAPHRAGM

blood-vessels, so that the impure blood brought from the heart by the pulmonary artery is distributed over the whole of the air-cells of the lungs, and is only separated from the air they contain by the thin walls of the air-sac and the blood-vessel, thus permitting an interchange of gases—the oxygen of the air passing into the blood, and the carbonic acid gas of the blood passing into the air.

Why Air enters the Lungs.—The air is brought into the lungs by the simple process of enlarging the capacity of the thorax or chest. The walls of the chest are formed by the ribs, which incline slightly downwards, but in the act of inspiration these are raised, thus enlarging the chest laterally; at the same time the diaphragm, which forms the floor of the chest, contracts and becomes much flatter, thus enlarging the chest in that direction. When the chest is enlarged air will flow in just as it does into a pair of bellows when we open them.

Quantity of Air Breathed.—The amount of air which enters and leaves the lungs each time we breathe is about 30 cubic inches, but by a special effort we can inhale another 100 c. in., or after taking an ordinary breath we can by a forcible expiration expel another 100 c. in. beside the 30 c. in. of tidal air, and there are still 100 c. in. of air remaining. This gives the capacity of the chest:—

Residual air	100 c. in.
Supplemental air	100 c. in.
Tidal air	30 c. in.
Complemental air	100 c. in.
Total . . .	330 c. in.

Step IV. Formulation.

An element is a substance that cannot at present be resolved into more simple substances.

A *compound* is formed by the union of two or more elements.

Chemical Action.—(1) Gives rise to fresh substances.
(2) No matter is destroyed, simply changed.
(3) Heat is evolved.

The Composition of Inspired and Expired Air.

	Inspired Air.	Expired Air.
Oxygen . . .	20·96 per cent.	16·03 per cent.
Nitrogen . . .	79 ,,	79 ,,
Carbonic Acid Gas .	·04 ,,	4·4 ,,
Water Vapour . .	Variable.	Saturated.
Temperature . .	Variable.	That of the body.
Organic Matter . .	...	Small quantities.

The Respiratory Apparatus.—The lungs and air-passages (trachea, bronchi, and bronchial tubes).

The ribs and diaphragm enlarge the chest, and thus allow the air to enter the lungs.

Total capacity of the chest about 330 c. in.; an ordinary breath about 30 c. in.

Step V. Application.—The application of the facts learned in these lessons will be that more attention will be paid to ventilation. As, however, there are right and wrong ways of ventilating a room, this will have to form the subject of our next section.

The "Practical Teacher" Advisory Board.—We are pleased to find that our idea of an Advisory Board does really meet a want, and we have sent replies by post to all who have submitted their difficulties. The great pressure on our space precludes us from giving the replies in this month's issue, but we hope in future to select some matters which are of most general interest.

NOTES ON AN EXPERIMENTAL COURSE OF LESSONS ON PLANT LIFE AND SOIL.

BY EDWARD J. RUSSELL, D.SC. (LOND.),
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IN the following notes, the author proposes to set out the experiments and data he used in a course of lessons given at the village school at Wye to the upper standards (mixed IV., V., VI., and VII.). The children had previously taken the course on Air and Water already published in these columns; they had therefore become accustomed to experimental lessons, and could even follow rather complex and involved experiments, which, without their previous training, would have been unintelligible.

There must always be a certain amount of labour involved in preparing an experimental lesson; but the keen interest aroused in the children, the rapid progress they make in learning to use their eyes, and to think about and remember what they have seen, and, above all, the habit they acquire of appealing to experiment to gain fresh knowledge, will more than recompense the enthusiastic teacher. The child's imagination is very vivid, and from a mere description of a thing, no matter how full, strange weird pictures are apt to be evolved, utterly different from the one we meant to present. But when we have the actual thing before the class, there can be no mistake; the lesson becomes very real; and, after all, the simplest thing in nature is much more wonderful than our best word-pictures can ever paint it.

Syllabus.

Plant Life.—The seed, what it is made of. Conditions necessary in order that it may change into a plant: how these conditions are secured in gardening. The changes the seed undergoes when it changes into a plant.

Some of the substances found in plants, and their functions. Breathing and feeding of plants. Changes during growth. Flowers, their colour, scent, and honey. Their use to the plant.

Seed-making.

Death of the plant, decay, and the substances produced.

The Soil.—What it is made of; how it can be broken up into its constituents. Properties of the separate constituents.

Some practical and geographical consequences arising out of these properties. Model spring and river. The action of water on the soil.

The organic matter in the soil. A peat bog and how it is formed. Presence of iron in the ditches in the bog. Some practical consequences.

Living organisms in the soil, and the work they do.

Soil in its relation to plants.

Plant Life.

THE SEED, AND WHAT IT IS MADE OF.

Few, if any, seeds are better adapted for school purposes than ordinary beans. They are large, and can be easily examined; they readily germinate, and the young seedling is very hardy, and can be left without any attention for two or three days. The bean will therefore be frequently used in these lessons. Other hardy seeds are mustard, oats, peas, wheat, etc.

In trying to find out the substances of which a seed is composed, the most fundamental method one can use is to heat the seed, and collect and examine the products obtained.

Experiment 1.—Heat successively in a test tube broken beans, peas, and wheat. A black substance is left in the tube, and something very much like steam is evolved.

The seeds appeared quite dry at the beginning; it is therefore necessary to test carefully before definitely deciding whether steam is produced or not. For this purpose the escaping vapours are condensed.

Experiment 2.—Connect a U tube to a test tube by means of a piece of glass tubing bent twice at right angles and fitted with corks. Put up a second exactly similar piece of apparatus. Into one test tube introduce some wheat grains, into the other the same weight of beans, broken if necessary. Fix both test tubes into a tin of olive oil placed over a burner, surround the U tubes by tins or beakers of cold water. Apply heat to the oil tin; as the temperature rises vapours are given off from the seeds, and partly condense in the U tubes to a slightly yellow liquid. Weigh the liquid produced; let the class examine it. It is chiefly water with a little tarry impurity.

The percentage amount should then be calculated. The seeds mentioned above contain 11 to 13 per cent. of water.

It is not desirable to heat the oil above the temperature at which it fumes strongly.

Experiment 3.—The test tube is now removed from the oil bath, wiped, and fitted with a cork through which passes a short piece of glass tube drawn out to a jet. As a higher temperature is wanted for this experiment than for the last, the tube is now heated in the flame. Fumes are given off, which in a short time burn with a bright light. Hold a piece of glass or a cold plate in the flame. Soot and moisture are produced.

The fumes will partly condense to a tarry liquid.

Experiment 4.—Fit a test tube to a U tube as in Experiment 2, but have only one bend in the connecting tube, so that the test tube is at right angles to the other, and not parallel, as in the former experiment. Place seeds in the test tube, and heat with a burner. Water first condenses in the U tube as before, and then, when the temperature rises higher, some dark tarry matter distils over.

Experiment 5.—Allow the test tube to cool somewhat, and shake out the residue. Note that it is black, and makes a mark on paper exactly like charcoal. Place some on a deflagrating spoon, heat strongly, and plunge into a jar of air. After a short time pour in a little lime-water, and shake. The lime-water turns milky. Do the same experiment with a piece of charcoal; the same result is obtained. The gas is carbonic acid, which has already been studied in "Air and Water," Experiments 50, 54, 60, etc.; and the experiment teaches us that seeds contain carbon.

Experiment 6.—Repeat Experiment 5 with the soot obtained in Experiment 3; it will be found that the soot also gives carbonic acid, showing that soot also contains carbon.

These facts are further demonstrated by the following experiment:—

Experiment 7.—Put some seeds in a wide glass tube ($\frac{1}{2}$ inch diameter), closed at each end with corks fitted with short glass tubes; then attach at one end

a U tube kept cool with water; to this join a small flask containing lime-water, and fitted with a cork containing two tubes, one just dipping into the flask, the other dipping under the lime-water. It is now necessary to pass air through the apparatus: this may be done with bellows, or, more conveniently, by means of an aspirator. Heat the seeds: they burn in the current of air, and the products of combustion are carried forward into the cold U tube, where the water condenses, and into the lime-water flask, where the carbonic acid produces a turbidity.

If an aspirator is not available, a very useful substitute may be made thus: Obtain a large bottle (preferably a chemist's Winchester quart bottle), fit the cork with two tubes as wide as possible, one just reaching inside, the other touching the bottom of the bottle. Bend the longer tube at right angles outside the bottle, and attach by rubber tubing another long tube, also bent at right angles, forming a syphon. Suck some water out through the long tube; it continues to flow, and, in escaping, draws air through the shorter one.

We learn, then, that seeds on heating yield water, a combustible gas containing carbon and hydrogen (since it produces water when it burns), and a residue of charcoal. Three of the constituents of the seed are therefore—

carbon, hydrogen, oxygen.

The next experiments assume some knowledge of the properties of ammonia, with which the girls happened to be familiar, but the boys were not. The dilute solution was handed round the class in order that the smell might be noted; its action on vegetable colours was then demonstrated. The least troublesome method is to redden some litmus solution and show that ammonia brings back the blue colour; but, as most children are not acquainted with litmus, I prefer to use commoner substances. Two of these answered perfectly well, and were well known to the class—privet berries and red cabbage. An infusion was made by covering the well-bruised berries or leaves with water and heating for some time in an evaporating basin; if cabbage is used, it is desirable to add a little dilute sulphuric acid. The extracts obtained behave exactly like litmus; they turn red with acids and blue with alkalis, and, when evaporated down with blotting paper, they give useful test papers.

Experiment 8.—Warm some ammonia in a test tube, and hold in the vapour a piece of moistened red test paper. The paper turns blue. In another test tube warm some of the tarry liquid of Experiment 4; this also causes reddened test paper to become blue.

It is necessary to avoid excess of acid in reddening the paper. After dipping the blue paper in dilute hydrochloric or sulphuric acids, well wash with water to remove the acid.

Experiment 9.—Heat some wheat, peas, or beans in a test tube, and hold a piece of red test paper in the escaping gases. The test paper turns blue, suggesting that ammonia is given off.

The experiment works more smoothly if the seeds are broken in a mortar and mixed with a little soda-lime. This substance is, as its name implies, a mixture of caustic soda with lime; heated by itself it gives off no ammonia, because it does not contain the necessary element, but it greatly facilitates the liberation of ammonia from the compounds present in seeds. Should soda-lime be used, a little of it should be heated in order to convince the class on this matter.

(*To be continued.*)

SUGGESTED COURSES OF TEACHING IN HYGIENE AND TEMPERANCE.

FOR BOYS AND GIRLS IN THE PUBLIC ELEMENTARY SCHOOLS OF THE UNITED KINGDOM.

NOTE.—*It is proposed that one lesson per week be given.*

TOPICS SUITABLE FOR CHILDREN UP TO SEVEN YEARS OF AGE.

To be gradually introduced in Sections according to age. (Oral Instruction with observation. Book for Teachers' use adapted to such Instruction.)

Position.—Sitting and standing erect. Chest position. Drilling, marching, and orderly self-controlled movements.

Playing.—Play necessary for children. Teach games and train to be fair, to avoid anger, selfishness, and rudeness.

Sleeping.—Sleep needed by animals, children, and everybody. Children need far more sleep than adults because their bodies have to grow very fast.

Eating.—What animals eat. What children should and should not eat. Why not between meals. The teeth and their care.

Drinking.—Water and milk good drinks. Tea and coffee not good for children. The juice of ripe fruits healthful in the fruit, but not after being pressed out and allowed to stand. Beer, wine, and cider unwholesome and injurious drinks. Beer renders people drowsy and less fit for work.

Clothing.—Of birds and other animals; of children. Summer and winter, damp and dry clothing.

Cleanliness.—Soap, water, and individual towels. Care of hair, teeth, nails, nose, feet, clothing, and desk. Use of door mat.

Growth.—Helps to growth: wholesome food, work, play, sleep, fresh air and sunshine. Hindrances to growth such as alcoholic drinks and tobacco.

The Body as a Whole.—Trunk, limbs, and head. Relation of correct position to a well-formed body.

The Head.—Parts of the head and face. Uses and care necessary. Kind and loving thoughts make attractive faces.

The Nose.—What facts are learned by smell. Other uses of the nose. Use of handkerchiefs. Colds from breathing impure air.

The Arms and Hands.—Parts of the arm. Parts, uses, and care of the hand.

Legs and Feet.—Uses and parts of the leg. Parts of the feet. Proper dress and care of feet. Strong, swift feet.

The Senses.—Sight: use; guard against close work and poor light. Hearing: training in quick and accurate hearing; how injured. Feeling: its purpose. Smelling: its use. Taste.

Touch.—Where the sense of touch is located. Distinguish between objects that are hard, soft, rough, smooth, etc.

TOPICS SUITABLE FOR CHILDREN OF ABOUT EIGHT YEARS OF AGE.

(Oral Instructions, Diagrams, and Simple Experiments. Book for Teachers' use adapted to such Instruction.)

1. Pure Air and Breathing.—How air gets to the lungs. Why air of rooms needs to be changed often. Importance of fresh air in the bedroom during the night. The airing of bedrooms in the morning.

2. Food.—Need of food for growth, strength, warmth. Effects of eating too much or too often. Rules for eating. Proper choice of food. Effect of too much meat. Nature's foods for the young. Materials which furnish these.

3. The Teeth and Stomach.—Trace mouthful of food from plate to stomach. Importance of good teeth; of chewing food. Loss of saliva in chewing or smoking tobacco. Evils of spitting. The stomach and gastric juice. Work and rest for the stomach. Irritating effect of alcohol. Danger of giving alcohol to infants and children.

4. Drinks.—Water needed in considerable amount by the tissues. Proper choice of drinks; harmful drinks; drinks that injure the stomach; injurious effect of strong and stewed tea; danger that cider, beer, or wine drinking may create the desire for more. Self-control in eating and drinking.

5. The Bones.—Bones of arms, fingers, head. Relation of framework to shape of body. Care of bones. Why sit and stand

erect. Difference between framework of the young and the old. Tobacco and alcoholic drinks liable to stunt growth of bones.

6. **The Muscles.**—How the body moves. Difference between muscle and fat. Exercise and proper food strengthen, alcoholic drinks weaken, muscle. Soldiers march better and navvies work better without alcohol.

7. **Tobacco and Cigarette Smoking in Youth** hinder growth and healthy physical and mental development: contain nicotine and sometimes other harmful poisons.

Topics Suitable for Children about Nine Years of Age.

(Text-Books, adapted to grade, in hands of Pupils as additional source of information, Diagrams, Simple Experiments, and Oral Instruction as before.)

1. **The Framework.**—Why many pieces in human skeleton. Different shapes of bones. Animal and mineral matter in bones. Location of principal large bones. Joints: how held together. Effect of tight clothing or ill-fitting shoes.

2. **Muscles.**—How made up. How they move bones. Sizes and shapes. Tendency of beer to cause the storing of fat instead of the formation of muscle. Relation of muscle and fat to strength.

3. **Exercise.**—Good forms of indoor and outdoor exercise; why the latter is preferable; proper dress.

4. **Respiration.**—Air as a purifier. The air passages. Air sacs of the lungs. Full, deep breathing. The advantages of well-developed lungs. How air is polluted. Airing living-rooms.

5. **Circulation.**—Right and left sides of heart. Veins and arteries. Veins that can be seen. How the blood feeds the body. Need of good food to make good blood. The blood as an air carrier and a food carrier.

6. **The Brain and Nerves.**—Work of brain. How made strong and how rested. Spinal cord. Connection with legs, arms, etc. Alcohol benumbs brain and nerves, making them act more slowly and less accurately. Self-control needed in life; power of alcohol to weaken self-control. Effects of tobacco on the growth of the body, on the moral habits of children.

7. **The Senses.**—Show that sense organs do not see, hear, taste, touch, or smell, but are only avenues to or instruments of the mind. Continue training of senses.

8. **The Skin.**—The skin a garment; why it does not wear out. Work of the skin. Oil and sweat glands. Danger of cooling off too quickly. Bathing as a preventive of taking cold. Clothing: proper fit, disposal of weight, protection for legs and feet. Injurious effect of alcohol in dilating the vessels of the skin, thus lowering bodily temperature and rendering the person more prone to disease.

Topics Suitable for Children of Ten and Eleven Years of Age.

(Text-Books, adapted to age, in hands of Pupils, supplemented by Diagrams, Simple Experiments, and Oral Instruction.)

Food.—Milk and eggs the most complete foods. Need of cereal foods. The part of meat which makes muscle. Good value of cheap cuts of meat; of vegetables and fruit. Sources of common foods. Best ways of preparing foods. Why food should be attractively served. Danger from contaminated water and bad milk. The cause of decay; work of moulds and alcoholic ferments. Fermentation changes character of substances; use of yeast in bread-making. Sugar a food; alcohol a member of a group of poisonous substances.

Digestion.—The two sets of teeth. The cutting and grinding teeth. Bone-making food necessary for preserving the teeth. Toothpicks and tooth-brushes. Dentist's care. Forming taste for healthful foods in childhood. The epiglottis. The gullet. Changes in food in the stomach. The intestines and their blood vessels. The lacteals and fatty foods. Passage of other food into blood vessels. How food is used by the muscles and other organs. Action of alcohol in retarding digestion.

The Blood.—Appearances of blood under microscope. Work of its corpuscles. Clotting. Healthy blood necessary for strength of body and power of mind. Blood vessels. Capillaries. Meaning of circulation. Relation of good food, pure air, and exercise to healthy blood.

The Heart.—Auricles. Ventricles. Valves. Number of beats per minute. Hearts, like other muscles, strengthened by regular exercise. Effect on the heart of alcoholic drinks and tobacco. Alcohol produces irregularity of action, weakens heart.

Respiration.—Need of air in the blood. Where the blood comes in contact with the air. Importance of breathing through the nose. "Adam's apple." Structure of windpipe and lungs. Elasticity of lungs. Change of air in air-sacs. Why air once breathed is unfit to be re-breathed. Development of the lungs by deep breathing, by "forced respiration," by exercise. Avoidance of constriction of chest by tight lacing and waist-bands. Simple methods of ventilation in the home and schoolroom. Why and how dust should be avoided.

Body Heat.—Source of body heat. Oxygen and burning. Fuel foods. Regulation of heat by skin. Relation of clothing to body heat. Effect of exercise on warmth. Effects of alcohol in dissipating heat valuable to the body.

Excretion.—Skin a protection. Cause of corns. Skin as an aid in removal of waste. Sweat glands. Deposits left on skin in perspiration; consequent need of bathing. Alcohol enlarges capillaries of skin. Alcohol avoided by Arctic explorers—such as Dr. Nansen. Formation of hair and nails; use and care. Why the hair needs frequent washing. Proper time for washing and bathing. Importance of cleanliness of underclothing, and of bedding. Need of waste matter being properly expelled from the body and not retained. Cultivation of good habits in this respect.

THE SENSES.

1. **Sight.**—Pleasure derived from it. The eye: shape, bony socket and cushion of fat; muscles; tear-gland; lashes; lids; pupils. Danger in reading in too strong a light or by twilight, when lying down, or when the eyes smart. Avoidance of small type and poor paper. Uncleanliness and "sore eyes," touching eyes with dirty fingers. Danger from public wash-basins and public towels.

2. **Hearing.**—Outer parts of ears. Danger from blows. Protection from draughts and strong wind.

3. **Smell.**—Where the sense is located. Nerves of smell. Dependence of animals upon smell. Connection with taste. How affected by colds. Use in detection of foul air, gas, etc.

4. **Taste.**—Use. Papillæ of tongue. Nerves of taste. By what affected. How dulled.

5. **Touch.**—Nerves in skin. Where touch is most delicate. Why delicacy of touch is desirable and necessary for work. Such delicacy impaired by alcohol.

The Nervous System.—The brain as a receiver and director of messages. Cerebellum and motion. Cerebrum, the organ of thought. Relation of attention and clear thinking to brain power. Importance of rest and sleep. Alcohol weakens power to think, to recognise warnings of the senses, and to take proper precautions against danger. Alcohol the cause of many accidents on land and sea.

Topics Suitable for Children of Twelve to Fourteen Years of Age.

(Text-Books, adapted to grade, in the hands of Pupils, supplemented by Lectures, Diagrams, Models, and Experiments.)

1. **Plant Physiology.**—Sprouting and growth of plants; necessary conditions. Food stored in seed. Plant respiration, oxidation, and work. Parts, structure, organs The seed. Plant digestion. Plant and human physiology compared. Cells. Tissues. Organs. Systems. Health of the cells. Effect of alcohol on plant life.

2. **Framework.**—Vertebral column the axis of the body. Relative position of axis in man and animals. Correspondence of legs and arm bones. Purpose of elastic cartilage in spine. The shaft, cancellous tissue, red and yellow marrow of bones; soft bones of children. Joints: hinge, ball and socket joints.

3. **Muscles.**—Voluntary and involuntary. The stronger the muscles the more work accomplished. Alcohol decreases muscular power and consequent working ability. Beer, wine, and cider tend to lessen precision of muscular movements. How this has been proved by experience and laboratory experiments.

4. **Respiration.**—Breathing organs of land and water animals. Nasal passages, pharynx, vocal cords, trachea, lung structure. Pulmonary circulation. Respiratory movements of diaphragm and chest walls. Chest and abdominal breathing. Voice: how produced; its training. Results of insufficient ventilation of rooms. Causes contributing to disease of air-passages and lungs; over-crowded, poorly-ventilated houses, damp or sunless rooms, insufficient food and clothing, lack of out-door exercise. Effect of alcoholic drinks, depressing vitality and causing proneness to lung disease.

5. **Circulation.**—Valves and structure of right and left side of heart. Valves in veins. Wounds. Methods of checking bleeding. Change in heart structure caused by beer and other alcoholic drinks. "Tobacco heart."

6. **The Digestive System.**—The alimentary canal: parts, structure, and processes; glands, and digestive properties of their secretions.

Hygiene of Digestion.—Amount of food: as affected by age, activity, occupation, climate, etc. Preparation of food: reasons for cooking. Importance of regularity and moderation in eating: of careful mastication.

Absorption.—Of fat, albumen, sugar. Storing of sugar, of fat. Use made of proteid matter.

Nutrition.—What it includes: composition, digestion, and assimilation of foods. Definition of a food. Classes of foods: nitrogenous, or albuminous, starchy, fat, and mineral; what each supplies to the body. Food material in cereals, vegetables, fruit, meat, milk, and eggs. Unwholesome foods: indigestible food; unripe, over-ripe, or decayed fruit, stale vegetables and meats; adulterated foods; injurious drinks. Principles of selection of food.

Beverages.—*Water:* forms found in Nature; necessity for water in the body; kinds: spring, well, rain, river, salt, mineral, hard, soft, impure; principal sources of supply: rain, wells, springs, rivers, lakes; importance of pure water and ice supplies. *Tea and coffee:* sources, properties. *Nourishing drinks:* milk, chocolate, cocoa, and cereal drinks; when most useful. *Non-alcoholic refreshing drinks:* lemonade, orangeade, unfermented fruit juices, fruit syrups. *Alcoholic drinks:* why not classed as foods; effect upon digestion; upon other functions of the body.

Excretion.—How waste materials are formed in the body. Organs that remove waste; skin, lungs, kidneys, liver, and large intestine. Importance, size, and location of the kidneys; connection with circulation; separation of waste. How the liver removes waste. Hygiene of liver and kidneys: how affected by alcoholic drinks.

7. **The Nervous System.**—Harmonious action of organs. Brain the central controlling organ. Co-operation of nerves, spinal cord, and ganglia. The sympathetic nervous system. Reflex action. Habit. Narcotics: alcoholic drinks, tobacco, opium; effects upon the nervous system; dangers of moderate use. The selfishness and expense of the tobacco habit. Thirst induced by tobacco may lead to the habit of drinking.

OUR ILLUSTRATED GEOGRAPHICAL NOTE-BOOK.

THE FRENCH COLONIAL EMPIRE.

IN territorial possessions France is second among the great countries of the world, for her Empire is exceeded in area only by that of the British. True, the excess is large, but even 4,184,000 square miles to be controlled by one people forms a "white man's burden" of no little magnitude. It may be urged that the area is little more than that of the United States alone, but area is not the sole criterion of difficulty; that of the States is compact and continuous, inhabited by one people; in the case of the Empire, it consists of scattered territories in different parts of the globe, the homes of many races, differing in colour, speech, habit, and thought.

When Pope Sixtus IV. in 1481 granted to the King of Portugal all the countries his mariners might discover beyond a certain meridian, he initiated a movement of vital import to the whole world, for there set in an era of exploration and discovery such as the world had never seen before or since. The discovery of America, the rounding of the Cape to India, the sailing round the world by Magellan, were accomplished in less than two-score years. All these notable exploits were confined to the Spaniards and the Portuguese, while British and French navigators looked on with envious eyes. Their interests had hitherto lain nearer home; the English had been for centuries endeavouring to give effect to their claim to France; and France had been fully occupied in frustrating them.

In 1534, however, Jacques Cartier landed near Gaspe, and took possession of Canada for the King of France. Little was done with it until 1608, when Champlain founded the city of Quebec. During the next one and a half centuries France dreamed of establishing a great empire in the New World, and gradually extended her sphere of influence until it extended from Nova Scotia to Lake Superior and southwards to the Gulf of Mexico. Louisiana was named after Louis XIV.

In the meantime France turned her eyes in the direction of India, for the possession of which she entered into competition with the English and the Dutch, and she likewise established trading stations at various points along the coast. Hostilities between England and France were of frequent occurrence, and always the operations extended to the foreign possessions, some of which changed hands more than once. Tobago was taken by the English during the Seven Years' War; during the War of American Independence France seized her opportunity and regained it; and finally, during the Napoleonic wars, England again secured it. By 1760 the French were thoroughly worsted in India, and three years later, at Quebec, Wolfe forced the French to relinquish all hopes of a French Empire in the New World.

In later days French and British interests have clashed in Indo-China, in Africa, and in various Polynesian islands. Only in April 1904 did the Anglo-French Agreement amicably settle various disputed points in widely separated regions. Now the *entente cordiale* is an accomplished fact, the two nations can proceed side by side in carrying out their great work of civilising vast areas.

Going back only to the year 1880, the French foreign possessions did not exceed 500,000 square miles, and our Sketch Map and the Table of Areas and Populations will show what a remarkable expansion has taken place in twenty-five years. The year 1881 saw Tunis occupied; territory at the north of the Lower Congo followed in 1884; and Dahomey in 1893; and all the while constant extension into the Sahara was taking place. Timbuktu was occupied by 1894, and the whole of the Algerian and Saharan deserts up to the boundaries of Egypt now belong to France. Madagascar fell under French sway in 1896. In Asia, Annam and Tonking were obtained in 1884, and Laos in 1893.

THE FRENCH EMPIRE.

	Square Miles.	Population.
Asia	256,000	18,000,000
Africa	3,684,000	35,000,000
America	31,000	400,000
Oceania	9,000	85,000
	3,980,000	53,485,000
Europe	204,092	38,962,000
Total	4,184,092	92,447,000

The French are proud of their achievements, and declare that if the British will only discard India from their totals, the French Empire exceeds the British in population. Although they have met with a large measure of success, their methods of dealing with new territories differ very largely from ours. The British system is to allow the subject peoples a large measure of self-

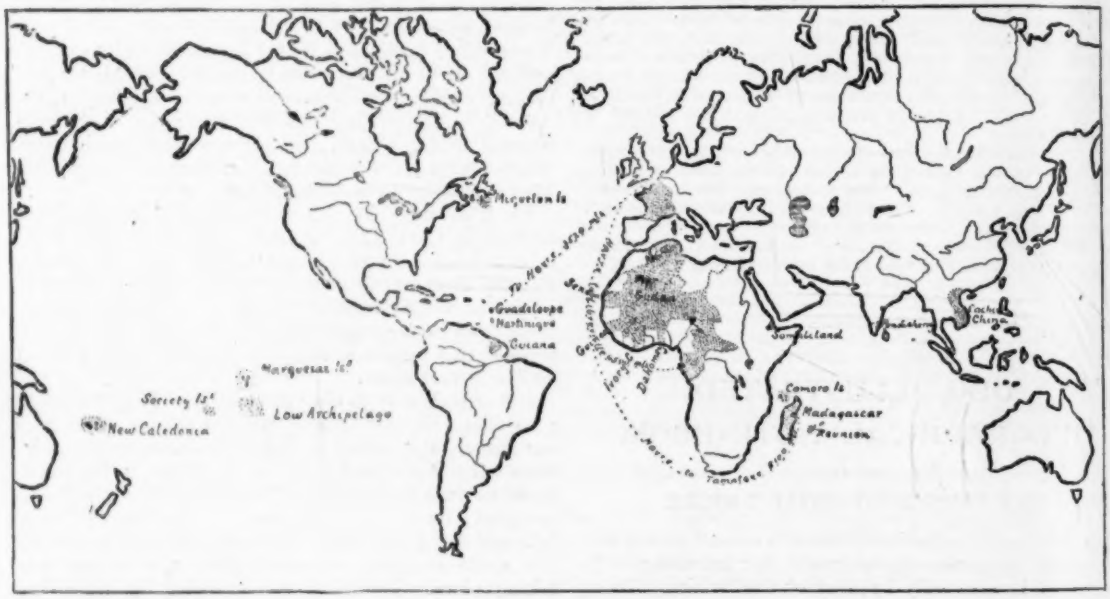
control under the administration of civil officials; the French rely largely upon military administration, and hence in the numbers of Europeans resident in their colonies the military always form a large proportion.

Within the limits of one short article it is impossible to describe the French Empire in detail, and a few interesting facts and figures must suffice.

Algeria.—This territory has been occupied since 1830, and is not now considered a colony, but rather an outlying portion of France. Area, about 185,000 square miles; population, 4¾ millions. The country consists of three regions. The *Tell* is the coast region, fruitful valleys alternating with cultivated lands among the mountains; further inland is mountainous table-land, affording pasturage for cattle; and still further in the rear, the country merges into the Sahara in scattered oases. Of rivers there are practically none in summer; in winter they are too swollen for navigation, but are available for irrigation. The French have worked wonders, even on the fringes of the Great Desert, by sinking artesian wells; and the population has been trebled in what were almost sterile regions. Fruits are grown for the French, English, and German markets; and for the vine, tobacco, and silk culture the country offers great facilities. Wheat is particularly successful; esparto grass is an important export. Minerals—iron, copper, quicksilver and lead—are abundant, but are yet little worked. There are 2000 miles of railways opened. During a year quite 2000 vessels enter the Algerian ports. Algiers, the capital, is an important coaling station, and a European health resort.

Tunis.—Though nominally ruled by the native Bey, the country is really governed by a French Resident. In a treaty of 1881 it was agreed that the French should cease to occupy Tunis when the local government was able to maintain order. Such an ideal state seems too much to expect from Moorish rulers, and there is little prospect of the French quitting the country unless they wish it to slide back into the present condition of Morocco, "the home of worst abuses and the greatest cruelties." By the Anglo-French Agreement, France is left a free hand to deal with Morocco when occasion arises, and there is no doubt that, possibly in the very near future, France will occupy North Africa from the Gulf of Cabes to the Atlantic. The population of Tunis is 1,500,000, of whom 25,000 are Europeans, including 10,000 French troops. The productions resemble those of Algeria; exports, grain, oil, and wool.

French Congo.—The French settled on the Gabun river as early as 1841, but the present boundaries of the colony were marked out in 1884. The area is not less than 450,000 square miles, and the population is estimated at from 8 to 12 millions. Along the coast, as with all settlements in West Africa, it is very



unhealthy for Europeans. The natives grow manioc largely; the Europeans cultivate coffee, cocoa, and vanilla. The forests contain valuable timbers, and rubber is plentiful. Rubber, ivory, and timber are the chief exports, followed by oil nuts and palm oil. A railway is being constructed to connect the colony with the Congo Free State and then on to German East Africa.

Dahomey.—This country, with its area of 60,000 square miles and a population of a million, was annexed by France in 1893. It was formerly one of the darkest regions in the whole of Africa. The king was an incredible despot, and the most fearful atrocities marked all state ceremonies. Some white hostages seized by the King of Dahomey were the eye-witnesses of some extraordinary and terrible scenes. The following is an interesting description of the Dahomean camp:—

"We saw before us at least 15,000 men drawn up in battle array, motionless, and so silent that, though within 100 yards of our prison, we had no idea of their being there. Silent ourselves, and a prey to deep emotion, we traversed their serried ranks, and, after a quarter of an hour's march, reached the second line, consisting of 4000 Amazons, who form the bodyguard

of the king, armed with rifle and knife, and ready to attack at the slightest signal of their master." Abomey is the capital of the colony, and palm oil and kernels the chief exports.

Ivory Coast.—Lying between the British Gold Coast colony and the black Republic of Liberia, the French Ivory Coast has an area of 120,000 square miles. The French call it the "New Transvaal," for it is rich in gold, not only in quartz reefs but also in the banket formation that founded the fortunes of the Rand. Marchand, better known for the incident at Fashoda, described it as "a country perspiring with gold." Captain Burton long before this said of the Ivory Coast in general that "the kings were immensely rich from the product of their mines, though the natives had merely scratched the top soil and nibbled the reef walls." Two-thirds of the colony is one dense forest, only cleared for the sites of the native villages. Palm, mahogany, and rubber trees alone assure much wealth, and the coast towns are known as "the timber ports." The natives wash for gold, and it is doubtful if anywhere in the whole world are "gold-dust and nuggets so largely owned by natives." Rubber collecting and palm-oil trading occupy many of the people, whose own wants are chiefly supplied from the banana groves and coco-nuts that surround their villages. The Ivory Coast was once largely known as the "Bristol" Coast, for the mariners of that port, a few generations ago, traded with the natives in calicoes, beads, rum, gin, salt, tobacco, muskets, kettles, bugles, etc. In return they received palm-oil and gold-dust, etc., and the profits seldom fell below 800 per cent. Great Britain is still the chief trader with the Ivory Coast, but it is doubtful if the trade carries the same profits.

Senegal and Guinea.—These regions are similar to most West African settlements. Oil-nuts, palm-oil, and rubber are the chief exports.

West African Railways.—Railway lines are already in existence or under consideration in each of the West African settlements. They are chiefly of little length, and run mainly at right angles to the coast. A writer in a French magazine deprecates this system, and urges that the Senegal must be linked with the Niger and the Congo with the Nile. With this medial and principal artery would gradually be connected the secondary veins of this well-organised body. The cities would be connected with the villages. Africa would be another and larger Europe, and the capitals of its various royalties or republics would be so many small or large Parises.

Madagascar.—The island is the third largest in the world, with an area of 230,000 square miles and a population of 2½ millions. The Portuguese discovered Madagascar in 1506, but in 1540 their few settlers were all massacred by the natives. The Dutch and the English attempted to succeed where the Portuguese had failed, but eventually retired. The French tried to form a colony in 1642, under the patronage of Richelieu, but thirty years later they were forced to abandon it. Though the French continued to look upon the island as part of their dominions, it did not become an accomplished fact until 1895. From the coast mountains rise to great table-lands in the interior. The rivers are unnavigable, and abound in crocodiles; and scorpions and serpents add to the discomforts of life. The river valleys, though fertile, are unhealthy for Europeans. Rice and manioc are yielded in abundance; sugar, cotton, tobacco, and rubber flourish.

Probably the island was never under one sovereign, but the Hovas at least held sway over the central parts. In 1810 King Radama promised to effect great changes in the island. He made a treaty with the British; English soldiers drilled his army; missionaries were admitted; schools were opened; and printing was introduced. In succeeding reigns, however, progress was not continued, the missionaries were driven out, and many of the converts suffered death. A new queen in 1868 signalised her accession by the burning of the royal idols, and in later years the negro slaves were emancipated. The people are skilled in handicrafts, and their cotton, cloth, linen, and silk goods are of excellent quality.

The French sent several expeditions to the island at various times, and in 1895, after many hardships caused by the difficulties of transport, occupied the capital. From that time Madagascar lost its last claim to independence, and it is now a recognised possession of France. The island is being rapidly opened up, and a railway from Tamatave, the chief port, to Antananarivo, the capital, is already completed. Gold, rubber, cattle, and hides are the chief exports. French domination immediately effected a great change in the trading relations of the island. In the first year British cotton imports alone fell from £111,000 to £6000, while French cottons rose from £27,000 to £220,000; an excellent example of the difference to the British trader of the open and the closed door.

Reunion Island is very similar to our own island of Mauritius. Sugar is the chief product, in the cultivation of which a large number of Hindoo coolies are employed.

French Somaliland.—This is a strip of land 125 miles long and 5 miles wide, situated upon the Strait of Babelmandeb. It is of growing commercial importance, and with the completion of a railway to the capital of Abyssinia the exports of ivory, gold, coffee, and gum will largely increase. Of the railway from Jibuil on the coast over a hundred miles are completed, and from the terminus the railway company has organised camel caravans to facilitate transport still further inland.

French India.—By treaties effected in 1814 and 1815, the French retain a footing at five different points—Pondicherry, Karikal, Chandernagar, Mahé, and Yanaon. Their total area is about 200 square miles. *Pondicherry*, on the Coromandel coast, is the capital. It was once strongly fortified, but by the Treaty of Paris its fortifications are not to be rebuilt, nor are French troops permitted beyond sufficient for police purposes. *Chandernagar* is 17 miles north of Calcutta; *Karikal* in the Cauvery delta; *Yanaon* in the Godaveri delta; *Mahé* is on the Malabar coast. The imports and exports show the little importance of France in the country to gain possession of which she unsuccessfully spent much blood and treasure. In 1886 the trade of the French possessions amounted to 32½ million francs; in 1901 to less than 4 million francs.

Miscellaneous Islands.—*Miquelon* and *St. Pierre*, off the coast of Newfoundland, are mostly barren rock. *New Caledonia* is an island convict settlement. Coffee, maize, tobacco, manioc, and sugar are the chief productions. Nearly all the agricultural labour is supplied by the convicts, together with imported Kanakas. The *Society Islands*, of which the chief is Tahiti, have an area of 600 square miles. In Papeete, the capital, in a population of 4280, more than half the people are French.

Our Modern Language Section

FRENCH PRIZE COMPETITION.

RULES.

1. All translations should be **posted not later than January 8th, 1906**, and addressed:—PRIZE EDITOR, Office of the *Practical Teacher*, 35 and 36 Paternoster Row, London, E.C.
2. Competitors should cut out and send the Coupon which appears on the Back Wrapper page of the current number.
3. Competitors should write pseudonym only on MS. Prize-winner will be asked to send name and address for publication.
4. No competitor may take the prize offered more than once in three months.

A Prize of Half a Guinea is offered for the best rendering into English of the following extract:—

Louis XVIII., après cette terrible scène, était rentré dans ses appartements. Le duc de Raguse prit les bras de la malheureuse comtesse et la conduisit à moitié évanouie à sa chaise à porteurs et de là chez elle. Revenue à elle, Mme. de Lavalette s'abusait encore de l'espoir de fléchir le Roi et était prête à renouveler une tentative désespérée. Marmont, lui, ne s'y trompait pas. L'occasion avait été très belle, la circonstance trop dramatique pour que le Roi n'en eût pas profité s'il avait voulu être clément. Néanmoins, et on doit louer le maréchal de cette courageuse fidélité au malheur, il consentit à faire une nouvelle démarche le lendemain. Le 19 décembre était le jour de naissance de la duchesse d'Angoulême, et en même temps l'anniversaire de sa sortie du Temple qui avait eu lieu vingt ans auparavant. Le souvenir de malheurs analogues, la similitude de prison, l'exagération du châtiment et l'acharnement des mauvais conseillers de la royauté, tout devait agir sur le cœur d'une princesse qu'on croyait moins dure et hautaine qu'esclave rigide du devoir. Madame la duchesse crut devoir se méfier des élans de son cœur et de la surprise d'un attendrissement. On fit redoubler les sentinelles, condamner les portes qui conduisaient à son appartement particulier. Précaution inutile du reste, car au pied de l'escalier du Roi, Mme. de Lavalette et le maréchal étaient arrêtés et priés de s'éloigner. Tant était grande la naïveté de la comtesse que même au retour de cette fâcheuse équipée, elle se leurrait encore d'illusions, disant au duc de Raguse, "Ils veulent n'accorder la grâce de mon mari que sur l'échafaud."

LE COMTE FLEURY.

RESULT OF THE DECEMBER COMPETITION.

The prize is awarded to "Francesca." Will "Francesca" kindly forward name and address for publication?

First Class.—C. E. U., van Baërle, Eicarg, Agaznog, Annabel Lee Gui, Rada, Fittick, Birchwood, M. E. C., Alcithoë, Gawayn, Travail, W. S. M., Shakspere, Mischka, Conor (S.), Dolly Winthrop, Conway, Coconnas, Awa Maru, Dewi Sant, Couturier, E. S. L. A., Myosotis, Chaos, Rifleman, Winnowsty, Cassius, Carpe diem, Q. A., K. T. G., Hamel, Summerbank, Stonefield, Youngster, Hazelwood, Semper eadem, Eversleigh, Leeds, Automobile, Ema, The Pirate.

Second Class.—Cæsar, M. I. M., Guillaume, Thawes, G. B., Beauty, Ceylon, La jeune fille, Little Mitch, Katerfelto, E. C. C., Mac O'Ardeer, J. M. J. B., Jean, Old Sexeian, A. B. C., Perseus, Christina, St. Serf, P. V. S., Rosepierre, Cinderella.

(The name and address of L. S. B., the winner of last month's competition, are Miss Lilian S. Bransby, 22 Whitmore Road, Birmingham.)

Report.

The general merit of the competitors, in spite of the proportion in the First Class, is not as high as it frequently is. A pretty large proportion of those in the First Class only scrape into that division. *La jeunesse en crise* was a difficulty to some. The prize-winner has given a pretty accurate rendering of it. *Dépaysés* was also a fairly general difficulty. Francesca's rendering of it is too literal. It would be quite right if our word "country" could bear the limited meaning the French word *pays* sometimes has. *Dépaysés* means "placed in unfamiliar surroundings." A candidate suggests, but without giving reasons, we should not insert the name of the author of the prize extract. We insert them for the purpose of guiding competitors in their reading. We have often thought of inserting the title of the work from which the extract is taken, and should like to know what our readers think of the idea. Another candidate asks how far explanatory words are admissible. While deprecating anything like a word for word translation, we think explanatory words or phrases are very rarely necessary. If the English word or phrase best expressing the idea of the French original is used, there will be hardly any need of explanatory words.

Prize Translation.

He had passed through the discipline of the army, but without recognising its use, or profiting by it, as he might have done. He had been under orders, he had been punished, he had come and gone at his superior's bidding, but no one had ever been a friend to him, no one had ever helped to keep those good if somewhat weak resolutions with which he had come from home, or treated him as a human being with a soul, and one whom his sacrifice, humble though it was, had raised. On the other hand, all the evil of the barrack-room had laid hold of him, the example of his messmates, their talk, their ceaseless efforts to evade regulations, their prejudices, the many vices of all those men snatched from their homes, taken from their country, unaccustomed to the temptations of the towns, and who, at the turning-point of their lives, found none to guide or help. He was neither better nor worse than the majority of the men who come back to their villages.

He brought with him to La Fromentière, a memory of evil haunts from which he never got away, a spirit of revolt against all authority, and dislike for the hard, irregular, uncertain labour of the fields, which he compared with civil employment of which he had but vague ideas, but which he had heard extolled on account of the shortness of the hours and regularity of the pay. It was only because he could not help it and for want of anything better, that he had come back to the care of the beasts and the plough.

The nearness of Chalons, with its public-houses and ill-conducted taverns, was a temptation to him. His comrades urged him on, and he, always weak and easily led, allowed himself to be persuaded. On Tuesdays, especially, the market day, too often his father saw his son of twenty-seven leave the farm at dusk on some pretext or other, and only come back late at night, dazed and insensible to his reproaches.

"FRANCESCA."

The Practical Infant-School Teacher.

SCHOOL GARDENING FOR LITTLE CHILDREN.

BY LUCY R. LATTER.

PART IX. (*Continued*).

"The light may lie in splendour on the wall,
And yet without man's skill that light is all.
The light alone no picture can produce.
. . . . . .
Who would God's comfort find must work with God.
Even life's shadows beautiful may grow,
If with Heaven's light we work them so."

Shadows.

What they are. How they are caused. How they vary in length and position. These variations determined by the position of the source of the light.

A child places a flower-pot, or some other simple object which is not transparent, in the path of a sunbeam. The class notice that a dark "picture," or shadow of the flower-pot, is formed. They tell on which side of the flower-pot the shadow is formed, and whether close to it, or far away from it. They notice on which side of the flower-pot the sunlight falls, and that it cannot get through it. A smaller flower-pot is placed immediately behind the bigger one. The children notice whether the sunbeam finds it, and whether any shadow of it is formed. They notice, when the sunbeam is passing by the bigger flower-pot, whether it passes over it, and where it strikes the ground. The children experiment with various other objects, and then decide that shadows are dark "pictures" of any objects standing in the path of a ray of light.

The children look for other shadows in the hall and in their class-rooms, and notice in each case what is standing in the way of the light and thus causing the shadow.

* *An individual child is allowed to move a lighted candle above a ball. The class watch and observe that as the light is gradually moved higher and higher (in the line of an arch) the shadow of the ball gets smaller and smaller until it almost disappears when the light is above the ball; and that when the light is moved gradually down on the other side of the ball the shadow gets longer and longer.*

* *Another child is allowed to move the light round the ball in such a way that it is parallel to it all the time. The class note what happens in this case.*

* *The experience gained by these little experiments is then applied to the position of the sun with regard to objects. A straight stick is put up in the playground. The children observe and mark with coloured chalks the shadows made on the ground by it at different hours. The shadows cast by the "verandah" railings are similarly observed and marked at different hours. The children watch their own shadows—their long morning and evening shadows, and their short noon ones. The shadows of moving objects in the playground thrown on the ceiling of the darkened room on previous occasions, recalled. The children are encouraged to observe any shadows of objects they pass on their way to school and on their way home again.*

Ideas of Time.

The sun sends its beautiful light beams to us in the morning. They come quite softly into our rooms. They touch our eyes very gently, then we wake up and know the day has come, and the time for work and play for birds and bees and flowers, as well as for the children and grown-up people. But by-and-by we do not see the sun, and the streets and roads are all dark. Night has come, the time for rest. Even many of the little plants get sleepy when it is dark. The next morning the sun rises as before, and after shining all the morning and afternoon it goes down again as night comes on. When does the sun "get up"? When does it go down? The beauty of the sunrise; of the sunset.

The children are encouraged to observe the flowers in the school-garden (eschscholtzia, flax, convolvulus, etc.) at different times in the day. They find out what flowers are "awake" in the garden when they come to school in the morning; what flowers are then still asleep; when they wake up; and whether any of them go to sleep before the end of the afternoon.

* *The children experiment with a lighted candle and an orange, if possible, in a darkened room, and find out that the side of the orange towards the light is illumined, whilst the side that is turned away from the light is in darkness.*

* *This experience is then applied to the question of day and night.*

The Sundial.

Long ago people had no clocks, as we have, to tell the hours. What do the children think they did then? They used to tell the time by watching the sun and the shadows. Then they made a kind of clock-face with figures on it; but instead of putting hands on it, such as we have on our clocks, they fixed a stick

* Points with an asterisk against them are only for the upper part of the school.

IV. The Gifts, Occupations, Games, Stories, Pictures, Recitations, and Hymns used in Connection.

(THREE MONTHS' WORK.)

	CLASS I.	CLASS II.	CLASS III.	CLASS IV.	CLASS V.	CLASS VI.
DRAWING (Free and other).	Windows through which the sun shines—in the hall, in classroom A, and in the teachers' room.† Flowers and tree buds which have opened out in the sunlight in school, in the garden, and Greenwich Park (crocuses, daffodils, hyacinths, and buds of the horse-chestnut, oak, maple, beech, birch, etc.). Window in the teachers' room with a sunbeam streaming through it and (*a*) meeting a bowl of clear water and forming a light picture of itself elsewhere in the room; (*b*) passing through a prism and showing its pretty colours on the floor. Rainbow and sun, their relative position. Miniature trees growing in school (horse-chestnut, oak, maple, etc.). A tree in the park touched by the sunlight. Picture of the sky as observed from the playground at a given time, of a grassy slope in the park, of any butterflies seen in the garden or which have "waked up" in school. A magnifying-glass. Shadows of various objects in school and in the playground (flower-pot, vase, stick, verandah railings, garden fence, individual children). Sundials—the face of the one used in the playground, of the one on the front of St. Luke's Church, Charlton. Hour-glass. Flowers in the garden at different times in the day (flax, eschscholtzia, etc.). Weather-vane on the top of the senior schools.	Windows through which the sun shines—in the hall, classroom A, and the teachers' room.† Flowers and tree buds which have opened out in the sunlight in school, the garden, and Greenwich Park (crocuses, daffodils, hyacinths, and buds of the horse-chestnut, oak, maple, beech, birch, etc.). Window in the teachers' room with a sunbeam streaming through it and (*a*) meeting a bowl of clear water and forming a light picture of itself elsewhere in the room; (*b*) passing through a prism and throwing its pretty colours on the floor. Rainbow and sun, their relative position. Picture of the sky as observed from the playground at a given time, of any butterflies seen in the garden or which have waked up in school. Shadows of various objects in school and in the playground (flower-pot, vase, stick, verandah railings, garden fence). Sundial—the face of the one used in the playground.	Windows through which the sun shines—in the hall, classroom A, and the teachers' room.† Flowers and tree buds which have opened out in the sunlight in school, the garden, and Greenwich Park (crocuses, daffodils, hyacinths, and buds of the horse-chestnut, beech, birch, elm, etc.). Window in the teachers' room with a sunbeam streaming through it and (*a*) meeting a bowl of clear water and forming a light picture of itself elsewhere in the room; (*b*) passing through a prism and throwing its pretty colours on the floor. Rainbow and sun, their relative position. Picture of any butterflies seen in the garden or which have waked up in school. Shadows of various objects in school and in the playground (flower-pot, vase, stick, verandah railings, garden fence). The face of the sundial used in the playground. † *Note.*—The windows in five of the six classrooms face the north or the east, hence the frequent reference to windows in the hall, the teachers' room, and classroom A, which more or less face the south.	The sun. The window through which the sun shines in the teachers' room.† Crocuses, daffodils, buds of horse-chestnut, beech, etc., which have opened out in the sunlight in school and in the garden. Portion of the fence round the playground on which the sun shines. A window-pane in the teachers' room with a sunbeam streaming through it. A hand-mirror, bowl, prism, rainbow. Sunshade. Shadows of various objects in school and in the playground (flower-pot, vase, stick, waste-paper tin). The face of the school clock.	Sun. The window through which the sun shines in the room.† Crocuses, daffodils, buds of horse-chestnut, beech, etc., which have opened out in the sunlight in school and in the garden. A window-pane in the teachers' room with a sunbeam streaming through it. A bowl, prism, soap-bubbles and pipe, rainbow, sunshade	Sun. The window through which the sun shines in the teachers' room.† Crocuses, daffodils, buds of horse-chestnut, etc., which have opened out in the sunlight in school and in the garden. A window-pane in the teachers' room with a sunbeam streaming through it. A bowl, hand-mirror, soap-bubbles and pipe, rainbow, sunshade.
BRUSHWORK AND COLOURING.	Crocuses, daffodils, hyacinths, and buds of horse-chestnut, beech, oak, etc. Rainbow and sun. Picture of the sky as seen from the playground at a given time. A ball and its shadow. Flax, eschscholtzia, etc., "asleep" and "awake."	Crocuses, daffodils, hyacinths, and buds of horse-chestnut, beech, oak, etc. Rainbow and sun. Picture of the sky as seen from the playground at a given time. A ball and its shadow.	Crocuses, daffodils, hyacinths, tulips, buds of horse-chestnut and beech. Rainbow. Ball and its shadow.	Crocuses, daffodils, tulips, and buds of horse-chestnut and beech. Rainbow, sunshade.		
MODELLING.	Crocuses, daffodils, hyacinths, buds of horse-chestnut and beech. Bowl, prism, sundial, weather-vane.	Crocuses, daffodils, hyacinths, buds of horse-chestnut and beech. Bowl, vase, sundial.				
PAPER FOLDING.	Mirror, tent, sunshade, pipe, balls of the colours seen through the prism, pick-axe, shovel (oblong and square-shaped paper).	Window, tent, flower, mirror, sunshade, fan (square-shaped paper).	Window, duster for cleaning window that the sun may shine better through it, sunshade, fan, mirror, tent (square-shaped paper).			

IV. The Gifts, Occupations, Games, Stories, Pictures, Recitations, and Hymns used (*Continued*).

	Class I.	Class II.	Class III.	Class IV.	Class V.	Class VI.
Gift IV. (Classes II. and III.) Gift III. (Classes IV. and V.) Tablets † (Squares).		Windows, school playground, plan of school-garden, stairs leading to the teachers' room, prisms, fireplace, shaft of a mine, summer-house, front of church with little toy dial added, school or church tower with toy weather-vane added.	Windows, school playground, stairs leading to the teachers' room, summer-house, fireplace, front of a church with a little toy dial added, clock, school or church tower with toy weather-vane added.	Windows, walls, stairs, and door leading to the teachers' room, playground, clock-tower, park gates. † Objects made with Gift III. reproduced on the flat.	The school, windows, walls, playground, clock-tower, park gates.	
Rings and Sticks (Class III.) Sticks or Laths (Classes IV., V., VI.)			Sun, crocus, window, bowl, glass vase, pipe and soap bubble, church, sundial, hour-glass, prism (sticks only), coal-box, fender, pick-axe, shovel, weather-vane, and butterfly.	Sun, window, bowl, sunshade, church, summer-house, garden-hat, fan, butterfly.	Window, tree, sunshade, summer-house, garden-hat, hand-mirror.	Window, tree, sunshade, summer-house, garden-hat, hand-mirror.
Jointed Lath (Class V.) Fraying (Class VI.)					Window, sunshade, church-tower, mirror, fan, summer-house.	Sunshade (closed), a rainbow colour-box, balls of all the colours of the rainbow.
Gift II. (Classes V. and VI.) Gift I. (Class VI.) †					Exercises with the ball (as the pendulum of a clock).	Exercises with the ball (as the pendulum of a clock). † Exercises with the balls of the various colours of the rainbow.
Sandwork.					A garden with a pond in it, park, hill. Playground (collective work).	Garden with a pond in it, park, hill. Playground (collective work).
Thread Laying. Bead Threading. †					Window, bowl, pipe, soap-bubble, sunshade, hand-mirror.	Window, bowl, hand-mirror, pipe, soap-bubble, sunshade. † Blind for the window.
Games.	Golden Sunshine. A Sunny Morning. The Thunderstorm. Closing Flowers.	The Sunbeams. Out in the Meadows. Over the bare Hills. The Sunbeam Sea.	The Light Bird (a quiet little sunbeam). Song for the Prism. Rainbow Song. The Shadow Rabbit.	Twilight and Dawn. Awakening Song. The Story of the Day. Sunbeams.	The Sunshine's Message. Good Morning, Merry Sunshine. The Sun. Sunshine Song. The Light Bird (O birdie, sweet birdie on the wall!) A Sunset Song.	Morning Sunshine. The Window. The Rainbow Ball Game. The Colour Game. Stars and Daisies. The Weather-Vane.
Marching Songs.	When the morning sun so bright. Up in the morning's cheerful light.	As in I.	As in I.	As in I.	As in I.	As in I.
Stories.	Demeter and Persephone. Aurora and Tithonus. A Story of a Lump of Charcoal.	The Light of Life. Phaeton. From Sunshine to Firelight.	Iris the Rainbow Queen. What the Clock told Dolly. The Carbon Fairies.	Clytie. The Sunshine Party. The Line of Golden Light.	The Sunbeams. The Wind and the Sun. Old Father Sol.	Up in the Spring. The Little Plant. The Sunbeams.
Pictures.	Aurora (Guido Reni).	Day and Night (Thorwaldsen).	Salisbury Cathedral (Constable).	Happy Days (Fred Morgan).	The Little Window (Froebel).	The Light Bird (Froebel).
Recitations.	Summer Time. The Children's Réveille. Starlight and Sunlight.	The Sun's Travels. Golden Rod. What the Coal Says.	Good Morning, Sunshine. My Shadow. What the Sunbeams became.	To the Sunbeams. The Rainbow. Day and Night.		
Hymns.	When the earth wakes up in gladness. The morning sun is shining. Summer suns are glowing (adapted).	As in I.	As in I.	As in I.	As in I.	As in I.

or rod on it in such a position that it threw a shadow which grew longer, shorter, and then longer again in the sunshine as the day advanced and declined. They noticed what happened to the shadow thrown by the stick when the sun was at its highest point in the sky, and determined the hours accordingly. Sometimes these sun-clocks, or sundials as they were called, were placed upright on the south wall of some big building. Sometimes they were placed in a horizontal position on a low pillar out of doors. Unfortunately, the sundial was of no use at night, nor on stormy or cloudy days when the sun was hidden; so the people had to think of another way of telling the hours. They tried to mark the time by means of sand and even water in curiously-shaped glasses; but this did not answer much better, so the people had to try again, and after a long time they succeeded in making clocks and watches such as we now have.

* *The children take a walk to St. Luke's Church, Charlton. Their attention is drawn to the sundial on the front of the south wall of the church.*

A small sundial is made indoors by individual children for use in the playground. Other children make a sun-clock on the window-sill of a room facing south, by the shadow of the casement. They chalk a line on the sill for every hour as the shadow advances, until—

"The day is done; and slowly from the scene
The stooping sun upgathers his spent shafts,
And puts them back into his golden quiver."

WORK IN THE GARDEN.

Completion of Spring sowings.

Tying up straggling bulbous plants and taking up of spent ones.

Stringing of runner beans and variegated hop.

Staking of broad beans, and sweet and other peas.

Putting up of scarecrows.

Cleansing of plants and ground from troublesome animal visitors, such as slugs, black-fly (aphis), and ants.

Nailing up of trailing ivy and jasmine sprays.

Tying up of lilac bushes.

Thinning out and transplanting of lettuces, carrots, cabbages, radishes, and onions.

Pulling of radishes and lettuces ready for eating.

Staking of tall sunflowers.

Watering, weeding, and tidying of beds and paths as usual.

Gathering of flowers and vegetables for gifts to friends, for distribution among the children, and for beautifying the school.

B. V.—List of Books referred to for Information and Reading.†

Star Land; Elements of Astronomy, Sir R. S. Ball; *The Expanse of Heaven; The Sun; Flowers of the Sky*, Proctor; *Elementary Lessons in Astronomy*, Sir Norman Lockyer; *A Text-book of General Astronomy*, C. A. Young; *On Light; The Forms of Water*, Tyndall; *The Fairy Land of Science*, Arabella B. Buckley; *Man's Place in the Universe*, Alfred R. Wallace; *The Book of Sundials*, Mrs. Alfred Gatty; *Commentaries on the Light Bird, etc.*, Froebel (S. E. Blow's Edition); *The Beauties of Nature*, Sir John Lubbock; *The Queen of the Air*, Ruskin; *The Old Benchers of the Inner Temple*, Charles Lamb (Essays of Elia); *Hymn to Apollo*, Shelley; *Address to Light; Morning*, Milton; *Hymn before Sunrise in the Vale of Chamouni*, Coleridge; *The Rainbow*, Campbell; *Tithonus; Demeter and Persephone*, Tennyson; *A Day of Sunshine*, Longfellow.

† Most of the books referred to are to be found in the Library of the British Museum. A long list is given because some of the books may be more easily obtained in some districts than in others.

List of Books from which the Games, Stories, Recitations, and Hymns have been selected.

Holiday Songs and Every Day Songs and Games, E. Poulsson; *Songs and Games for Little Ones*, Walker and Jenks; *Songs for Little Children* (Vols. I. and II.), E. Smith; *Song Stories for the Kindergarten*, M. J. Hill; *Stories in Song for Kindergarten, Home, and School*, Emerson and Brown; *Little Games for Little People*, D. Pearce; *The Children's Song and Game Book*, H. Keatley Moore, Mus.Bac., B.A.; *Kindergarten Chimes*, K. D. Wiggin; *Songs, Games, and Rhymes for the Nursery, Kindergarten, and Primary School*, E. L. Hailmann; *Songs and Music of Froebel's Mother Play*, S. E. Blow's edition; *Sea-Shell Songs*, L. Ormiston Chant; *Daisies and Breezes*, L. Ormiston Chant; *Nature Songs*, F. Hoare and C. H. Lewis; *Music for the Kindergarten* (Supplement 1), E. Heerwart; *Kindergarten Gift Plays*, M. E. Nuth; *Related Literature*, A. E. M'Govern; *Favourite Greek Myths*, L. S. Hyde; *Nature Myths and Stories*, F. J. Cooke; *Legends of Greece and Rome*, G. H. Kupfer, M.A.; *In the Child's World*, E. Poulsson; *Parables from Nature*, M. Gatty; *In Story Land*, E. Harrison; *Philadelphia, Kindergarten Stories*, L. von Kirk and M. G. Clark; *Child Garden* (Vols. III., VI., VII., VIII., IX., and X.); *A Child's Garland of Verses*, R. L. Stevenson; *A String of Pearls* (Verses for Children), Lady Lindsay.

CHRISTMAS FAIRIES.

SISSIE TURLEY BUTLER.

CHILDREN, do you ever wonder
How dear Santa Claus can tell
What we all want in our stockings?
Some one knows our secret well.

I believe that in the palace
Of the King, far far away,
Many happy little fairies
Dance around him all the day.

Just before the Christmas season
Santa Claus calls to them all—
"Come, my little Christmas fairies
You must leave my fairy hall.

"See, the snow is gently falling,
Step upon the flakes so white,
Fly to earth, and tell me truly
All the children say to-night.

"Should they want a doll, ball, whistle,
Write it down before you leave,
Then fly back, and I will pack them
In my sleigh for Christmas Eve."

Children, when the snow is falling,
Do be careful what you say,
For a fairy may be writing
What you wish for Christmas Day.

OUR TUTORIAL SECTION

OUR PUPIL TEACHERS' AND SCHOLARSHIP COURSE.

BY ARTHUR T. FLUX,

Late Principal of the Belvedere Pupil Teacher Centre, First on Scholarship List; Author of "Scholarship School Management," "Building of the British Empire," etc.

SCHOLARSHIP COURSE—PART II. 1906.

First Month—January.

Work to be Prepared.

I. *English Composition.*—Write one or two essays each week. The essay should be from 35 to 50 lines in length. The subject must in each case be well thought out, the ideas arranged on a definite plan in logical order and expressed in good English, clear, forcible, and well-balanced. The essentials for success in this exercise are a mind well stored with information and a command of language acquired by reading the best books. The importance of carefully reading masterpieces of literature and the effect—unconscious in many cases—is well illustrated by the essays I receive. If a student is asked to give in his own language the substance of one of Bacon's Essays, it is nearly impossible to entirely obliterate the peculiar phraseology of the original. Bacon is not the best model for young students to copy, he is too terse and epigrammatic, but they cannot read too much of Addison, of the delightful Elia, or Stevenson, to mention only a few of the treasures of the language. The well-balanced musical sentences, the apt quotation or illustration, the happy selection of the right word are examples which the young student may carefully copy.

As I have on previous occasions pointed out, the reading aloud of an essay is one of the best means of detecting weakness; what may escape the eye is immediately detected by the ear. No pains must be spared with this exercise, as it exerts a powerful influence on all the written work of the examination.

For this month write essays on the following subjects:—

(1) The differences in French and English character as illustrated in the play.
(2) A wreck.
(3) The character of Uriah Heep.
(4) Describe the visit of William of Deloraine to Melrose Abbey.
(5) The character of Richard I.
(6) The effects of the Crusades on Western Europe.
(7) Dickens as a novelist.
(8) Some reasons for Scott's popularity.

These subjects are taken from the books to be prepared, and therefore should be easy, as not only the material but also the model is to hand. The following suggestions may help:—

(1) The essential differences in character of the two nations are due to race and habitat. The English, descended from the Saxons, inherit their love of freedom, their bravery, and their stolid determination. The dash of Danish blood and the infusion of the Norman French element prevented their bravery and determination becoming stagnant dull stupidity, and gave them more alertness than is possessed by their cousins of Low Germany. The French, on the other hand, possessing a strong Romance element, resemble the nations of Southern Europe in their vivacity and fieriness. They are formidable in attack when their enthusiasm drives them in an overwhelming torrent on the foe, but they cannot endure patiently the attacks of others. Their gaiety is proverbial, but their disposition is not so fickle as cursory observance would lead one to suppose. Show how far does Shakespeare recognise this and show it in the play. Support your statements by quotations wherever possible.

(2) You can take as your model for this the description of the storm in which Ham perished—one of the finest, if not absolutely the best, description of a storm in the language.

(3) This should prove easy. Cunning, crafty, cruel, sensual, Uriah Heep stands out as one of the most complete villains in fiction. He has not a single good quality to redeem him, unless it be his friendship for his mother—one cannot call it love; and it is to be suspected that this was prompted by expediency rather than filial duty. Gratitude he had none; the nobler passions of a man were entirely absent. How much of this was due to heredity and upbringing, how much to a natural tendency to villainy, and how much to ambition, it is for the writer of the essay to determine.

(4) A good exercise in turning poetry into prose. Read over the scene as often as you like, but do not write the essay till some time has elapsed.

(5) The character of Richard I. is well drawn in *The Talisman*. He seemed to possess all the good qualities of the hot Plantagenet blood and not a few of its defects. Brave to rashness, eager to seize on any occasion to quarrel, he seemed more like a Paladin of the old romances than a king. He had none of that meanness which characterised his brother John, although possibly he was as cruel. He could unbend and converse to his yeomen without loss of dignity, but it was not safe to trespass on his good nature. His hot bursts of passion left him as suddenly as they came, but without any vindictive spirit remaining. He could be as generous to a Moslem king as a Christian prince, but his generosity was governed by impulse rather than reason. If you can get the book from a library, read Maurice Hewlett's *Richard Yea and Nay*.

(6) The subject of this essay may be largely gathered from the same book. Previous to the Crusades, the Far East was a dream, a hazy conception, to which the legendary tales of the fabulous wealth of Prester John, coupled with the wonderful imagery of the Bible, contributed to no small extent. Even to-day it is probable that Palestine is mentally pictured as the "land flowing with milk and honey" rather than the arid wretched waste that it is. The educative effect on any man in those far-off times who left the dales of Cumberland, the plains of the Midlands, or the downs of the south counties and embarked on a journey of months—across France and Italy on to Cyprus and the Holy Land—can hardly be over-estimated. The growth of knowledge was one result. Another result was the opening up of trade; the useful manufactures of the West filtered through to the East; in return came spices, filmy silks, perfumes, and other products of the Orient. With them also came less desirable things in the shape of the deadly Asiatic cholera and leprosy. The Church prospered out of these wild-brained expeditions. She acted as moneylender and pawnbroker to needy nobles, and many a man returned home ruined in health and wealth. Those who in the first flood of the religious enthusiasm took the Cross and afterwards repented could free themselves by payment—often of many a fair manor. The Crusades also raised and intensified the feeling of hatred to the Jews, since their share in the Crucifixion was brought prominently forward by the wave of religious enthusiasm which spread over the Continent.

(7) The reasons why Dickens' novels are and were so popular should be carefully thought out. In the first place, he had no competitor, and thus he gained the popular ear easily. But the continued popularity proves that it was not a mere accident which placed him in the forefront of English novelists; there must be something in the books themselves which enable them to live on in an age when most of the characters and scenes are out-of-date. The greatest feature is, I think, his power of characterisation. Amidst the crowd of men and women his fertile brain created there are no two alike, each stands alone clear and defined, a reasonable and possible being. In this respect he has only one superior—Shakespeare. Other novelists of lesser power write many books, but the same character appears in each. There may be a different name, a new nationality, a new *mise en scene*, but the character is the same with

unimportant minor differences—the face may be the face of Esau but the voice is Jacob's. In Dickens this is not so; you could not mistake Jonas Chuzzlewit for Heep, or Agnes for Dora, or Micawber for Sam Weller. Again the freshness and vivacity of description is always interesting. The people are not of our age or manners of thought, but we read of them with pleasure as we admire a picture by Botticelli, Rubens, or Cuyp. There is also a charm of humour pervading the pages, a kindliness of heart which appeals to all readers. The novels are not perfect, it is comparatively easy to point out defects, but this is beside the purpose.

(8) Why was Scott so immediately popular, what was there about the "Wizard of the North" which raises him at once to the pinnacle of fame? To understand fully one must go back a century to the "Augustan Age," as the writers of the time of Queen Anne fondly called their times, in the belief that they had reached the acme of perfection in poetry. What dreary stuff it was! The crowd of writers whom Pope pilloried in the *Dunciad* had vanished into limbo long ago but for their inclusion in this attack of bitter invective. They devoted their time to turning out acres of Iambic Pentameters on man and his duties. "The proper study of mankind is man" was their text, and man was told of his faults and failings, his duties and responsibilities, till he became heartily tired of hearing them mentioned. When the Lake School of poets found something to talk about in nature, though it was only "Daffodils" or "A Skylark" or a "Mountain Daisy," the reading public, in spite of the fulminations of the *Quarterly* and other reviews, turned to such subjects with a sigh of relief and content. And when Scott came forward with his tales of belted barons, border chiefs and marauding mosstroopers, written in a swinging measure and brimful of human interest, it is not to be wondered at that he was hailed with acclamation. The clash of arms on the lonely moors or in the pitched battlefield, the wild charge or lonely ride, the deeds of derringdo and chivalry appealed irresistibly to the wild Berserker spirit that lies only dormant in the best of us. We forgive Marmion's treachery for the sake of that last wild charge of his, we close our eyes to the fact that Rob Roy was a wild Highland cateran that deserved hanging many times over when we rejoice at his hairsbreadth escapes. Scott's pages breathe forth the "strenuous life," they are palpitating with action, and as such they appeal to a race instinct which prompted the charge of the Light Brigade, the defence of Rorke's Drift, the storming of Spion Kop, the sweeping charge of French's cavalry, or the stubborn defence of Long's guns. The quietest old city gentleman in his cosy club feels his nerves tingle as he reads and likes to picture himself as one of the band of heroes. To this spirit Scott largely appealed—and not in vain.

II. *English Language and Literature.*

1. *Parsing and Analysis.*—This exercise should now be fairly perfect. Care must be taken to state the relation of the sentences correctly—Principal, Co-ordinate, or Subordinate to another *sentence;* Adverbial, Adjectival, or Noun to a word. Enlargements of Subject and Object must go in separate columns, and the exact kind of extension of the Predicate should also be stated. In Parsing, parse fully, and state exactly the syntactical relation of the word.

Analyse the following, and parse words in italics. Send up for correction if you are in any doubt.

(1) I now proceeded forward, and *had walked* about two *hours*, when I perceived *what* appeared at a distance *like* a *waggon*, which I was *resolved to overtake;* but when I came up with it found it *to be* a strolling company's cart that *was carrying* their scenes and *other* theatrical furniture to the next village *where* they *were* to exhibit.

(2) He said *that* on the whole his opinion was that resistance *might take place because* of this reason, that civil wars in history had generally broken *out either* on religious questions or taxation questions, and the country *would probably be wounded* on *both* of these points.

(3) *Such* men *as* he *be* never at heart's ease
Whiles they behold a *greater than themselves,*
And *therefore* are they very dangerous.
I *rather* tell thee what is *to be feared*
Than what I fear; *for* always I am Cæsar.

(4) Our birth is a sleep and a *forgetting.*
The soul that rises with us, our life's *star,*
Hath had *elsewhere* its setting,
And cometh *from afar*
Not in entire forgetfulness and not in *utter* nakedness,
But *trailing* clouds of glory do we come from God who is our home.

2. *Etymology, etc.*—Those students who have learnt a regular number of roots and meanings each week will be able to answer any simple questions on this subject.

In the History of the Language, revise the Anglo-Saxon Period, and note the chief characteristics—highly inflected, power of forming compounds, etc. Note also the contributions prior to 1066—(*a*) The Keltic; (*b*) the Latin of First Period (Roman occupation) and Second Period (St. Augustine and his monks); (*c*) the Danish element. Learn a dozen words from each source.

3. Commence the revision of the Play. Look particularly for the beauties of language and the general meaning. Of course students must know the exact history of the period covered by the action, and be able to point out where Shakespeare is not in accordance with fact.

Revise the Essays on Truth and Revenge. You must be able to give the substance in your own words.

In the general reading, the books can be picked up at any time and read. You are expected to know the text sufficiently well to be able to explain any passage or reproduce a scene in your own words.

Prepare answers if necessary to the following questions:—

(1) The Code prescribes the study of grammar, "in so far as it bears on the correct use of language." Mention three instances of common errors in composition which are due to violation of grammatical rules. Explain briefly how in teaching composition to a class of older children you would proceed in order to correct these errors and to guard against their repetition.

(2) Write short notes of a lesson on one of the following subjects:—

(*a*) The various forms which the object of a sentence may take.

(*b*) Auxiliary verbs.

(3) What simple rules could you lay down which might help you to decide at once whether a word was (*a*) pure English; (*b*) Latin; (*c*) Greek in origin. Give instances to illustrate your answer.

(4) Construct sentences to show the difference of meaning between the following words, and point out in each case the force of the prefix:—

Deface—efface, absolve—dissolve, depose—oppose, apathy—antipathy, subvert—convert, aspire—inspire.

(5) Show in what way the etymology of the following names is interesting:—Lincoln, Whitby, Winchester, Stratford, Uxbridge, Portsmouth, the Cinque Ports, the Fossway.

(6) Point out and explain as to a class the inaccuracies in the following sentences:—

(*a*) Oxygen does not put out a burning taper, like hydrogen does.

(*b*) They brought cannon of great size and which made a terrible noise.

(*c*) Each of the kings which he saw carried a sceptre of their own.

III. *Geography.*—Continue the revision of the countries by preparing answers to Test Questions in Geography (Meiklejohn and Holden). Take regular practice in map drawing.

Read up the forms of government of the various colonies.

IV. *History.*—The reign of Elizabeth. This reign is one of the most important in English history, and therefore requires careful study. Learn definitely what there is in the text-book, and find answers if you can to the following questions:—

(*a*) What difficulties encountered Elizabeth on her accession, and how was each solved?

(*b*) By what means was a French invasion prevented and a Spanish invasion delayed?

(*c*) Was Elizabeth justified in executing Mary Queen of Scots?

(*d*) How do you account for the increase of trade and commerce in this reign?

(*e*) What events caused the Poor Law of Elizabeth?

(*f*) Give some reasons for the unsettled state of Ireland in this reign.

(*g*) How was the religious difficulty settled?

(*h*) Who were the Puritans? Give instances of their rising power.

(*i*) Why does Elizabeth deserve to be considered as one of the first English statesmen?

Notes on the Special Period, 1485–1588.

When a period is set for special study, there must be some reasons for the selection, and the student should endeavour to discover these reasons. The period is of immense importance. Comprising as it does only just over a century, it is nevertheless replete with important changes and great movements. The battle of Bosworth was the knell of the Dark Ages, the guns of the fleet which defeated the galleons of Spain were the unconscious salutes of a new England taking her place in the fore-

most ranks of the nations and as Mistress of the Seas. It will be impossible in the space at disposal to follow all the great movements in detail, but the more important of them will be dealt with, and the student must read up the period with a continual accompaniment of "why," why did the event occur, what causes tended to bring it about, what results accrued from it, how is this to be accounted for. This is the right mental attitude towards the subject, a mere knowledge of events and dates is of far less importance; and therefore the notes will be given in the form of question and answer.

1. *Why is the reign of Henry VII. considered as the commencement of Modern History?*

(*a*) The old feudal system was dead, in the new era mental ability rather than muscular force prevailed.

(*b*) The Revival of Learning opened men's minds to higher things, and the invention of printing disseminated knowledge.

(*c*) England broke away from the domination of the Church of Rome.

(*d*) Geographical discoveries gave an immense impulse to commerce and trade.

(*e*) A definite foreign policy was adopted.

2. *What were the reasons of the great personal power exerted by the Tudors?*

(*a*) The old powerful nobility were destroyed or weakened by the Wars of the Roses, the Statute of Livery and Maintenance (*q.v.*) prevented their return to power, and the new nobility were entirely subservient to the new monarchy.

(*b*) The clergy were lacking in enthusiasm and moral force, and relied on the king for support.

(*c*) The House of Commons was not representative or independent. The Disfranchising Act of 1430, which restricted the franchise to 40s. freeholders, took the power out of the hands of the people.

(*d*) The increase in wealth of the merchants caused a desire for peace and for a strong rule.

(*e*) The Crown was the only remaining political power, wealthy by confiscations and fines, irresistible by possessing the only artillery.

3. *What steps did Henry VII. take to render his position secure?*

(*a*) Confiscation of Yorkist estates.

(*b*) Execution, etc., of prominent Yorkists, *e.g.* Earl of Warwick, 1499; De la Pole, Earl of Lincoln, killed at Stoke in 1487.

(*c*) Marriage with Elizabeth of York.

(*d*) Accumulation of treasure rendered him independent of Parliament.

(*e*) Statute of Livery and Maintenance prevented nobility from becoming powerful.

4. *By what means did Henry VII. amass money?*

(1) Confiscation of estates and heavy fines after revolts.

(2) By Benevolences or forced loans in 1492, 1497, and 1504.

(3) By obtaining subsidies from Parliament to carry on wars which were not undertaken.

(4) By exactions of the Star Chamber.

(5) By fines for the infringement of obsolete statutes—through the agency of Empson and Dudley.

N.B.—The money amassed by the king rendered him independent of Parliament.

5. *What was Henry VII.'s foreign policy?*

It was in this reign that anything like a definite foreign policy was adopted, and this centred round the idea of the "Balance of Power." As communications between the chief European nations increased, each country jealously watched the progress of others, and alliances and treaties were made to ensure that no nation should obtain a preponderating influence to the danger of the others. This "Balance of Power" is the basis of all alliances, *e.g.* Elizabeth and the Netherlands to check Spain; the alliance of England, Netherlands, and Germany over the Spanish succession; England and France against Russia in the Crimea; England and Japan against Russia, etc.

Henry VII.'s policy from 1485 to 1492 was centred round Brittany. Charles VIII. attacked the Duke of Brittany. Henry, Maximilian, and Spain entered into a league for its protection, and volunteers were raised in England for its defence. But when Charles married Anne of Brittany the league fell through, and Henry received £149,000 to refrain from attacking France. From 1492 to 1498 the revolt of Perkin Warbeck drew attention to Flanders, but when in 1496 the "Magnus Intercursus" (a commercial treaty securing freedom of trading and expulsion of rebels) was arranged, Warbeck was compelled to leave. France was shut to him by the Treaty of Etaples, and Ireland was closed to him by Poynings Law (all English laws to have force in Ireland, no Parliament to be held there except by consent of the king and council, and any laws passed by the Irish to be subject to the veto of the king).

In 1497 Warbeck was excluded from Scotland by the terms of a treaty with the Scots. It will be noticed that Henry was fighting his cause by diplomacy and had practically won before Warbeck landed.

6. *What important marriages took place in the reign, and with what results?*

(*a*) Prince Arthur, the king's eldest son, with Catherine of Arragon—alliance of Spain and England against France. On the death of Arthur, marriage of the widow to Prince Henry—conditionally sanctioned by the Pope. This resulted ultimately in the Divorce question, which grew into the Reformation.

(*b*) Marriage of Margaret with James IV. of Scotland—ultimate accession of the Stuarts to the throne.

7. *What was the Star Chamber?*

This was a court constituted by Henry VII.—a Committee of the Privy Council—to deal with the disorder consequent upon the Wars of the Roses; but its sphere of action soon widened until in the succeeding reign it was a private law court of the king, used for personal power and aggrandisement and entirely unconstitutional in its action and opposed to the common law of the country. It was useful in dealing with persons whom the ordinary law courts were afraid to touch. A person was arrested privately, examined and judged. No information was given as to the charge, and no legal defence was allowed. Any punishment short of death was inflicted—whipping, stocks, pillory, torture. Henry VII. used it to exact heavy fines. The following were some of the offences dealt with:—Accusation of treasonable acts or words, libel, erroneous verdicts by juries, breach of royal proclamation, offences not provided for in the ordinary law, and any case which the king liked to transfer from the ordinary law courts.

8. *What was the Revival of Learning, and how was it caused?*

The Revival of Learning, or Renaissance, or Renascence, was a movement which affected the whole of Western Europe. Up to the fifteenth century Europe had been in a continual state of unrest. As in England, so in other countries, there were many questions to be settled which could only be solved by "blood and iron," "might" was "right," and physical prowess more highly esteemed than mental power. Hence the period is called the Dark Ages. Learning still survived in the monasteries and a few universities, but it was an accomplishment of the few. Barons disdained to write their names—the clerics (clerks) could see to all such unimportant matters. The introduction of artillery and the use of firearms altered this; the ignorant peasant with a primitive gun was more than the equal of the proudest Paladin, mail-clad and armed with sword and lance. Brains rather than muscle won the day, and hence the desire to know arose. The civil wars of Italy had driven the scholars to the Eastern Court at Constantinople; but when this city was captured by the Turks in 1453 and the Eastern Empire fell, they were scattered over Europe, taking with them the priceless manuscripts of classical learning. The religious controversy also created a desire for knowledge, and hence schools and colleges were founded, teachers employed, and men turned from the clash of arms to the quest of the study. There was no national literature as yet, and therefore for history men turned to Thucydides, Herodotus, Tacitus, Livy; for philosophy to Aristotle, Plato, Epictetus; for poetry to Virgil, Horace, and Homer; for drama to Sophocles, Euripides, Aeschylus, Terence, and Plautus. The churchman found wisdom in the writings of the early fathers, the soldier in the commentaries of Cæsar and other warlike histories, the ordinary citizen in the newly translated Bibles. The recently invented printing presses supplied books at a cheaper rate than could ever have been done through the slow copying of the monks in the scriptorium. The difference between the commencement and the end of the Tudor Period is immense. In 1485 there were no English books beyond Chaucer's poems and a few scattered poems by Langland, Gower, Nicholas de Guildford, etc.; in 1603 England possessed a literature of which we are justly proud. Not only in literature, but also in architecture, art, and science, vast strides were made. Compare the uncomfortable castles of the thirteenth century with the spacious and beautiful Elizabethan mansion.

As a result of this increased knowledge, trade and commerce increased rapidly, and soon there was little of the world not explored.

Revise to the end of the Norman Period. See that you can answer all the questions in Test Questions in History (Meiklejohn and Holden) set on this period.

V. *Algebra.*—Work the following paper:—

(1) What is meant by an equation, and how does it differ from an identity?

What do you gather from the statement that $x = 1$ is a solution of the equation $5x^2 + 189x = 194$?

What is the other solution?

(2) Multiply together $81x^4+16y^4$, $9x^2+4y^2$, $3x+2y$, $3x-2y$.
Divide $27x^3-8y^3-27c^3-54xyz$ by $3x-2y-3z$.

(3) Prove that $\frac{y-z}{1+yz}+\frac{z-x}{1+zx}+\frac{x-y}{1+xy}=\frac{(y-z)(z-x)(x-y)}{(1+yz)(1+zx)(1+xy)}$.

(4) Solve the equations (a) $\frac{15}{x}-\frac{4}{y}=3$.

$$\frac{9}{x}+\frac{8}{y}=7.$$

(b) $$\frac{1}{x+2+\frac{1}{x+3}}=\frac{1}{x-2+\frac{1}{x-3}}$$

(5) Write down two common multiples of the fourth degree in x and y of the following:—

$$2x^3-xy-y^3 \qquad 2x^3-3xy+y^3.$$

Also find their G.C.M. Has the latter any binomial factor other than the given expression?

(6) In a walking race B finishes 2½ hours after A. If each had walked a mile an hour faster A would have arrived at the winning-post 1½ hours before B. Assuming that in both cases A walked a mile an hour more than B, find their speeds and the length of the course.

Solutions.

(1) $5x^2+189x-194=0$.

Factor $(x-1)(5x+194)=0$. $5x=-194$, etc.

(2) $(81x^4+16y^4)(9x^2+4y^2)(3x+2y)(3x-2y)=$

$(81x^4+16y^4)(9x^2+4y^2)(9x^2-4y^2)=$

$(81x^4+16y^4)(81x^4-16y^4)=$

$81^2x^8-16^2y^8$.

The division is of the form $a^3-b^3-c^3-3abc \div a-b-c$.
Knowing your factors the answer to this is—

$$a^2+b^2+c^2+ab+ac-bc.$$

Substitute values.

(3) Add the three fractions and factor the numerator.

(4) (a) $\left(\frac{15}{x}-\frac{4}{y}=3\right)=\left(\frac{30}{x}-\frac{8}{y}=6\right)$

$\left(\frac{9}{x}+\frac{8}{y}=7\right)=\left(\frac{9}{x}+\frac{8}{y}=7\right)$ when $\frac{39}{x}=13$. $x=3$, etc.

(b) Simplify fractions—

$$\frac{x+3}{x^2+5x+7}=\frac{x-3}{x^2-5x+7}$$

or $x^2+2x^2-8x-21=x^3-2x^2-8x+21$

$$4x^2=42$$

$$x^2=10{\cdot}5, \text{ and } x=\pm\sqrt{10{\cdot}5}.$$

(5) By inspection $x-y$ is a factor of each and hence will be of the G.C.M.

(6) Let x = B's rate in miles per hour.
Then $x+1$ = A's rate . . .

$$\left.\begin{array}{l}\text{Therefore } \frac{y}{x}=\frac{y}{x+1}+2\frac{1}{2} \\ \text{and } \frac{y}{x+1}=\frac{y}{x+2}+1\frac{1}{2}\end{array}\right\}=\begin{cases}4y=9x(x+1) \\ 2y=3(x+1)(x+2) \\ \quad \text{or } 4y=6(x+1)(x+2).\end{cases}$$

Hence $9x(x+1)=6(x+1)(x+2)$

$$3x=2x+4, \text{ and } x=4.$$

Therefore B's rate = 4, A = 5, and distance = 45 miles.

VI. *Euclid.*—Finish Book II. and work six deductions per week.

Work the following:—

(a) If a line be drawn perpendicular to, and bisecting the line joining two given points, any point in the former line is equally distant from the given points.

(b) ACB is a right-angled triangle and from C the right angle CD is drawn perpendicular to the hypotenuse AB. Prove that the angle ACD is equal to the angle ABC.

(c) Find a point such that if straight lines be drawn from it to the angles and to the middle point of one side of a triangle, the triangle shall be divided by these lines into four equal triangles.

(d) Show that the area of a rhombus is half the rectangle contained by its diagonals.

(e) The lower end of a straight rod which is standing against an upright post fixed in the ground is moved horizontally along the ground in a straight line away from the foot of the post, while the upper end slides down the post. Show that the middle point of the rod will describe the arc of a circle whose radius is equal to half the length of the rod.

Plot this on squared paper.

Women.—Answer the following:—

(1) Define a parallelogram and a circle. Show how your definition of the latter is not satisfied by any figure drawn upon the surface of a sphere.

(2) Divide a given straight line into two equal parts.

(3) Equal triangles on the same base and on the same side of it are between the same parallels. The diagonals of a parallelogram ABCD intersect at O. X is any point such that XO is parallel to BC. Show that the triangles BXC, AXD are equal.

(4) Simplify $\frac{1}{x^2-5xy+6y^2}-\frac{2}{x^2-4xy+3y^2}+\frac{1}{x^2-3xy+2y^2}$

(5) A sum of £12 is made up of half-crowns and florins. If there are 100 coins altogether, find the number of each kind.

VII. *Elementary Science.*—The chemistry of the common metals.

Answer the following:—

(a) How would you prepare crystals of sulphur from flowers of sulphur?

What experiment would establish the chemical identity of the various forms of sulphur?

(b) In what form does hydrochloric acid exist under ordinary atmospheric conditions?

Explain what occurs when HCl is allowed to come into contact with (a) a solution of lead nitrate; (b) nitric acid; (c) bleaching powder; (d) metallic sodium.

(c) What is an oxidising agent? In what sense are the following substances to be regarded as oxidising agents:—(a) chlorine gas; (b) nitre; (c) water?

(d) $$8NH_3+3Cl_2=6NH_4Cl+N_2.$$

What facts and what theories are expressed by the symbols employed in this equation?

PUPIL TEACHERS' COURSE.

For Candidates' Examination, 1906.

Work to be Prepared.

1. *Reading and Repetition.*—Take regular oral practice in these subjects, remembering that the main object is the proper interpretation of the author's meaning.

2. *English.*

(1) Learn ten roots and meanings each week from the *Pupil Teachers' English Note-Book.* If this is steadily done you will soon possess a most useful stock of etymological information.

(2) Prepare answers to the following questions:—

(a) Add to each of the following verbs a termination to form a noun signifying the *agent:* bake, save, pave, beg, propel, abet, thunder, buy, sail, occupy, purvey, open, reflect, carry, possess.

Form the Present Participle Active of the verb: die, dye, sing, singe, concur, open, frolic, travel, see, magnify.

(b) Analyse the following:—

"In the rusty grate there is not a spark,
The door from its hinge is gone,
The wainscot is mouldy and damp and dark,
And shattered the threshold stone."

(c) Parse: "Methinks that I had broken from the Tower."

(d) Criticise the grammar of the following sentences:—

(1) Neither of these suits me.
(2) That is mine and nobody else's.
(3) For conscience sake.
(4) Who do you say she is?

(*e*) What are the distinguishing features of a Strong Verb? Give six examples of such verbs.

(*f*) Explain, with examples, the meaning of the following words as grammatical terms: prefix, suffix, inflection, diminutive, patronymic, composition, derivation.

(*g*) Write out in prose in your own language—

> "An 'twere not for thy hoary beard
> Such hand as Marmion's had not spared
> To cleave the Douglas head.
> And first I tell thee, haughty peer,
> He who does England's message here,
> Although the meanest in her state,
> May well, proud Angus, be thy mate."

(3) *Marmion.*—Canto iv., first ten stanzas.

(4) *Composition.*—Write one or two essays each week on such subjects as—

(*a*) The benefits of a good education.

(*b*) The advantages of minerals to the country in which they abound.

(*c*) Advantages of the sea to a country.

(*d*) Ventilation.

(*e*) Patriotism.

(*f*) Lifeboats and their work.

(*g*) "Evil is wrought by want of thought
As well as want of heart."

Read up the subject if necessary. Arrange your ideas in logical order and write in your best language, revising carefully and repeatedly. The subjects are fairly easy.

(*a*) The advantages are obvious—mental, moral, and social.

(*b*) Deposits of mineral are wealth to the country, provided that they can be obtained mined at less than they sell for.

(*c*) The chief are—

(1) An equable climate as opposed to a continental one of extremes.

(2) Generally—a sufficient rainfall and therefore fertility.

(3) An easy means of trade and commerce with all parts of the world.

(*g*) A very true statement. Half the evil in the world is the result of thoughtlessness or carelessness, and very little thought will supply dozens of examples.

3. *History.*—Henry V. and to 1485.

The chief points will be given in the *Text-Book;* the following points require careful attention:—

(1) Henry V.'s campaign in France. Prepare with a sketch map showing route.

(2) The loss of the French provinces and the causes for this:—(*a*) The impossibility of fusing nations of entirely different characters into one. (*b*) The loss of the Burgundian alliance. (*c*) The strong patriotism aroused by Joan of Arc.

(3) Jack Cade's rebellion.

(4) The Wars of the Roses:—

(*a*) The cause—learn a genealogical table showing the rival houses.

(*b*) The battles, leaders, and results.

(*c*) The results of the Wars—downfall of the Feudal System, etc.

(5) The growing trade with Flanders.

4. *Geography.*—China and Japan.

Read up all you can in the *Text-Book* about these countries. Try and obtain a just appreciation of the vast size and population of China, its prosperity from land cultivation, its exclusiveness and opposition to European influences. On the other hand Japan is the England of the East. Just fifty years ago the English and American navies forced them to open ports—in this brief time they have advanced as much as other countries have done in two or three centuries. The recent war has raised Japan to the front rank among nations, and our alliance with them is a valuable asset towards the world's peace.

5. *Arithmetic.*—Simple and Compound Interest. Read up the theory; work by method purely, and not by any formulæ. Work through as many of the exercises in Christian and Collar as you can.

6. *Algebra.*—Problems on Simple Equations. Take care always to state definitely what x is equal to. Do not say, Let x=A, but x=A's rate in miles per hour, etc.

7. *Geometry.*—Continue exercises on any of the syllabus.

8. *Music.*—Exercises in Transition.

9. *Science.*—Formation of Oxides of Lead. Preparation of oxygen from red lead, mercuric oxide, and potassium chlorate. The properties of the gas and the compounds formed by burning substances in it.

10. *Spelling.*—100 words from *Words Commonly Misspelt.*

11. *Penmanship.*—Write a page daily in the *Practical Teacher Copy-Book.*

Test Questions.

1. Write as specimens of copy-setting:—
Large hand.—Frederick the Great.
Small hand.—Florence is noted for its galleries of art treasures.

2. Explain the different kinds of subordinate sentences, and give three examples of each.

3. What are the chief vegetable productions of India, which are exported largely, and to what countries?

4. What do you know of Poona, Benares, Hooghly, Teral, Simla, Tapti, Deccan? What is a Durbar?

5. Say what you can of the *causes* of the Peasants' Revolt.

6. What do you know of the Lollards?

7. Write the following in the Imperfect Method, *i.e.* without change of key:—

d m s ᵈr d t, l, f m r ᵈs f m r d

8. Of what does air consist, and how would you prove its composition?

All communications respecting this Course to be sent to Mr. ARTHUR T. FLUX, Oakleigh, Belvedere, Kent, together with the coupon of the present number, and a stamped addressed envelope if an immediate answer is required.

OUR CERTIFICATE COURSE FOR 1906.

BY GEORGE COLLAR, B.A., B.SC.,
Head-Master of Stockwell Pupil-Teacher School.

Test Questions on Last Month's Work.

THEORY OF TEACHING.

1. Discuss the special value of history as a school subject.

2. Show that the treatment of history should vary greatly at different periods of the scholar's life, and sketch a course of lessons for one term's work in Standard IV.

3. How does Froebel deal with Nature study?

ENGLISH LITERATURE.

1. Who had been the chief English sonnet-writers before Milton, and what models had they followed? What is the metrical form of most of Milton's sonnets?

2. Give the date and occasion of these sonnets: (*a*) "When the Assault was Intended to the City;" (*b*) "To the Lord General Cromwell;" (*c*) "On the late Massacre in Piedmont."

3. Explain the following allusions:—

(*a*) New foes arise,
Threatening to bind our souls with secular chains. (xi.)
(*b*) The bounds of either sword to thee we owe. (xii.)
(*c*) A book was writ of late called Tetrachordon. (vi.)
(*d*) The false North displays
Her broken league to imp their serpent wings. (x.)
(*e*) The drift of hollow states, hard to be spelled. (xii.)

ENGLISH HISTORY.

1. Give an account of Wentworth's rule in Ireland.

2. What steps did Cromwell take to establish a settled government in England after 1649?

3. Give an account of Sir John Eliot, Pym, and Fairfax.

GEOGRAPHY.

1. Point out the advantages of the geographical situation of Ulm, Milan, Hamburg, Lisbon.

2. Give an account of the facilities for transport enjoyed by Germany, and show how they promote her foreign commerce.

3. Explain as far as you can the character and distribution of the French woollen industry.

ARITHMETIC.

1. A person sells an article so as to gain 5 per cent. If he had bought it at 5 per cent. less and sold it for £·05 less, he would have gained 10 per cent. Find the cost price of the article.

Note.—Your working and setting out of this simple sum should be in such a form as would be plain and intelligible to a class working sums of a similar type for the first time. (Certificated.)

2. A quarter of my money gains 3 per cent., a third gains 3½ per cent., and the rest gains 4 per cent. If the annual income is £64, 10s., what was the capital invested?

ELEMENTARY SCIENCE.

1. Two pieces of steel have an attraction for one another; how can you find whether one or both are magnetised?

2. How can you prove the law of inverse squares in magnetic attraction?

Notes and Syllabus for January.

ENGLISH COMPOSITION.

Prepare Chapters XVII. and XVIII. of the *Art of Writing English*. The rules for letter writing should not be necessary for students who are preparing for the Certificate Examination, but from correspondence we frequently receive we are driven to the conclusion that many of our readers stand in need of such guidance. It seems scarcely credible that a teacher would use the term "Gent." for "Sir" or "Dear Sir" in beginning a letter. Many other mistakes might be quoted from letters received; one point among others might be mentioned to which attention might be paid, and which is not referred to in the chapter:—Always use a full Christian name and not an initial in writing to a person to whom you are not known. It is very embarrassing to receive a letter signed "A. Brown," because in replying one does not know whether to address the response to Mr., Mrs., or Miss, and whether to open with "Dear Sir" or "Dear Madam." This, of course, may be obviated by enclosing a directed envelope, but still all risk should be avoided by using a full signature.

The eighteenth chapter is full of useful recommendations. Students using Nesfield's *Senior Composition* should master Chapters VIII. and IX.

Prepare and write essays on the following subjects:—

1. Socialism.
2. Fairy Tales in Education.
3. Lawful and unlawful pride.
4. Habits.

THEORY OF EDUCATION.

Study Chapter XI. of Collar and Crook's *School Management*, and attend very closely to the papers on the subject in this month and last month's *Practical Teacher*.

Finish Part I. of the *Student's Froebel*. The remarks on the subject of teaching composition are very important. We often give as a test or exercise in composition a passage to be written out in "the child's own words." But here we are on the horns of a dilemma, because if the child is thoroughly familiar with the words used, and would naturally use them to express his thoughts, they are certainly "his own words," and it is useless and ridiculous to make him search for others. Hence we must not forbid the use of a word because it comes in the original. On the other hand, the child's mind is often just like the cylinder of a phonograph—it takes the impression of the words that are spoken into it, and when wound up reproduces those words. There is no vitality or intelligence used, or at any rate very little. This habit of reproducing words without allowing them first to produce ideas which in their turn will find expression by the same or similar words, is not confined to young children. It occurs in older scholars and in adults, and we often hear a statement made which we believe to be the true expression of the speaker's thought, but yet it is really no index of what is actually in the speaker's mind. A student recently defined an indirect tax as "one that is paid by the consumer of the article in question—for example, the dog tax." Although objections might be raised with regard to the accuracy of the definition, it would naturally have been taken as a real expression of the student's thought, if he had not added the illustration. The example, however, proved that he did not have in his mind the idea which is denoted by the word "consumer."

In teaching writing the child's "self-activity" must be called into play, for drawing or picture-writing is an exercise that comes naturally to children as a means of expressing and recording their thoughts. Froebel holds that reading sprang from a wish to render audible to one's self and others that which has been written down. By reading and writing man rises above every other known creature, and approaches the attainment of his destiny. Froebel then makes the difficult statement that "Man first becomes a *person* by the practice of this art." This is probably only an exaggeration to emphasise the importance of reading and writing; for it is not true whichever meaning we put upon the word *person*. Man, of course, had an *individual existence* long before the invention of reading and writing. And if we take the original signification of *sounding through*, it is unquestionable that men carried messages that they had received orally long before they read out written communications. More true and important is the statement, "Writing connects men as present with the past and future." The boy must realise the need for reading and writing before he is set to learn them.

The presentation of what is within man, the true self of man, is art. Art touches mathematics or the understanding in one direction, it touches language or reason in another, the representation of nature in another, and finally it coincides with reason in another. As a means of representing what is in man's mind it takes various forms; as presentment of pure sound it is music, especially vocal music, or song; as presentment by colours for the sight it is painting; as presentment in space it is modelling or sculpture. The effort to draw appears at an early age in human development, and is followed a little later by modelling. Hence we conclude that "feeling for art is a general quality and gift of man, and it ought to be cherished from the first, at the latest in boyhood."

There must be a union of instruction with life; home life and school life must be regarded as parts of one whole, not as two separate things. We must be thankful for the great improvement that has taken place in the last thirty years in the relation between school and home. Parents of the lower classes are beginning to regard teachers as the friends of their children; but although a better feeling exists, many of these parents have not the opportunities or the knowledge necessary for full co-operation with the teacher. Children are not to be stamped like coins, all in the same mould, with an image and superscription which is not their own; they must follow the laws of growth from within, and develop like trees.

Froebel then gives a dozen "Means of Education."

1. To awaken, nourish and strengthen the religious sentiment which keeps the human heart in union with God.
2. To learn by heart religious sayings, to be used in prayer, etc.
3. Care, knowledge, and exercise of the body, as the bearer and instrument of the mind.
4. Contemplation and observation of nature and of the outer world.
5. To learn by heart short poems representing nature and life, some of these to be sung.
6. Exercise in language as a means of expressing thought.
7. Exercises in representing forms of matter, modelling.
8. Drawing with the help of squared paper.
9. Lessons on colours, with their application to given surfaces.
10. Play, or kindergarten games.
11. Telling of stories, fables, and fairy-tales, adapted to the events of the day, the seasons, etc.
12. Short journeys and long walks.

In justification of No. 5 Froebel says that nature often speaks to boys, but in so low a tone that they cannot reproduce her teaching in words of their own, hence they want a poet's guidance; and in speaking of such means as the seventh, which require the pupil to produce, he says, "Man is developed and formed for the attainment of his true destiny, in part by what he as a boy receives from without and takes *into* himself, but incomparably more through what he unfolds and represents *out of* himself. In this way our method follows nature. The occupations have not a special measurable purpose—they are aimed at the development of the boy himself; and we may feel sure that each one having been truly trained to be a man has thereby been educated as well as possible for every special duty, for each particular need, of civil and social life.

ENGLISH LANGUAGE AND LITERATURE.

Read through *Woodstock* two or three times; you will like it better each time. Like most of Scott's novels, it takes a long time for the reader to get into it and work up his enthusiasm, but on second reading he finds passages and scenes of great beauty and force which he passed by unnoticed the first time,

because he did not appreciate their connection with the whole work.

Read also Milton's *Areopagitica* with a view to studying it in detail next month.

English History.

Study the *History of England* from 1660 to 1760. Note the restoration proposals as set out in the Declaration of Breda, and the practical hindrances to their fulfilment. Prepare a life of Earl Clarendon, and endeavour to determine to what extent he shaped the national policy. The settlement of ecclesiastical matters occupies a considerable share of the early portion of this period. Note that the real effect of the Acts aimed at the Nonconformists was to separate them widely from the Anglicans, and to make the various Nonconformist bodies unite in opposition to the Established Church. Read the lives of Baxter and Bunyan.

The period we are studying now marks the recognition of the proper relation between the three branches of government, viz.:—legislative, executive, and judicative. In early times the King was supposed to exercise all three functions—to make laws, to administer them, and to judge and punish offenders against them. Until the Act of Settlement, 1701, judges had been both appointed and dismissed by the King. By that Act they were declared no longer to hold their appointments during the King's pleasure, but so long as they behaved themselves. This Act gave great independence to the judges, and contributed to the better administration of justice, because judges could give a decision even against the Crown without incurring risk. Previous to this a great step had been taken towards civil liberty by decision of Chief Justice Vaughan, that a juror could incur no penalty for his verdict if he gave it according to his conscience. This decision was given in the case of a man named Bushell, who was fined (and sent to prison for refusing to pay the fine) by the Recorder of London for acquitting the Quakers Penn and Mead, who were charged with unlawful assembly. To this decision and the clause in the Act of Settlement we owe our liberty in courts of justice.

There was still considerable difficulty in settling the proper relation between the legislative and the executive, but it was effected by the development of the responsibility of Ministers, and of the Government through a Cabal or Cabinet. Up to nearly the end of the seventeenth century the King was accustomed to choose his Ministers indiscriminately from either political party. This rendered effective control over the Ministers practically impossible, as the House of Commons could only deal with the Ministers by such a process as impeachment. At the suggestion of the Earl of Sutherland, King William III. adopted the practice of selecting his Ministers from the party which for the time being had a majority in the House of Commons. He retained a large number of advisers, who together constituted the *Privy Council*, and out of this Privy Council certain committees were appointed to carry on special work. Thus there is the Judicial Committee, which includes the chief judges, and advises the King what decision to give when he is called upon to act as a judge, *e.g.* as in case of a dispute between two colonies. Until quite recently there was a Committee of the Privy Council on Education, but the work of this committee is now carried on by the Board of Education. The most important committee of all, however, is the Cabinet, which consists of the chief Ministers or Secretaries of State. Each Minister advises the King on the matters which come under his special charge, but if the matter is important it is considered by the full Cabinet, and their collective opinion is given, and no member of the Cabinet is supposed to criticise or dissent from the opinion of the Cabinet. This principle of unanimity in the Cabinet was introduced by Sir Robert Walpole, who is generally spoken of as the Prime Minister, although there is really no such office constitutionally recognised as that of Prime Minister.

The life and work of the leading politicians should be carefully studied, with special reference to Clarendon, Shaftesbury, Godolphin, Harley, Bolingbroke, and Walpole.

The War of the Spanish Succession, the War of the Austrian Succession, and the Seven Years' War are the headings under which most of the foreign relations of the country may be gathered. The Seven Years' War did not end till 1763 (Treaty of Paris), but it marked a period of English naval supremacy, and of consequent extension of colonial power.

The rebellions of 1715 and 1745 were the two attempts to restore the Stuarts.

Geography.

Finish the geography of Europe. Notice the boundaries between states, and see in each case whether they are natural or arbitrary. In modern times many boundaries have been rectified and the political divisions made to correspond with differences of race and language. Notice the importance of the Seine and Loire as waterways, and the superiority of the former. The fertile soil and variety of climate make the agricultural products of France exceed those of any other country of equal area.

Paris may be regarded as owing its development to its situation at a point to which a number of trade routes converge.

Marseilles holds the leading position among French ports on account of its position, backed as it is by the large and accessible hinterland of Southern France, and being a convenient port for trading with the whole Mediterranean basin, and *viâ* the Suez Canal with the Far East. The ports on the west of France—Havre, Nantes, St. Nazaire, and Bordeaux—are important because of their accessibility from America, but with the exception of the cotton district round Rouen and the wine-growing district round Bordeaux they are lacking in a hinterland, and hence relatively do not compare with Antwerp, Rotterdam, and Hamburg, which are backed by the populous industrial districts of Belgium and Western Germany. The structure of Germany makes the Rhine a most important trade route; not only is there much traffic on the river itself, but there is a railway on each of its banks. Unfortunately the force of the current is such that passenger steamers run no farther up than Mayence, although tugs draw barges as far as Mannheim. The deficiency of river valleys running from west to east has been compensated for by the construction of railways. Facilities for transport of goods have done a great deal towards the development of German industries, particularly in the west. Notice the effect of the Kiel Canal. We have accounted for the importance of Hamburg: Lübeck was very important in the Middle Ages, as it commanded the Baltic trade. Berlin, Magdeburg, and Breslau are examples of towns which owe their rise to their situation at points at which it was possible to build a bridge over a river.

In studying Italy notice the geographical conditions which explain the importance of the city of Naples—originally a Greek colony, and for a very long while the most populous town in Italy.

Observe also how the two ports of Venice and Genoa owe their importance to their position, which enabled them to command the trade of the Mediterranean, and by the overland route at Suez to trade with the East Indies, the spice trade of which was of immense value when spices were used in preserving meat, as was the case before the introduction of methods of refrigeration. The discovery of the Cape route to India took away much of their importance, which has, however, been largely restored by the opening of the Suez Canal—a benefit which has been shared by Trieste, the port from which the Austrian Lloyd liners start for East Africa, etc. The hinterland of Venice includes the populous plain of Lombardy, and by the Brenner Pass the southern parts of the Austrian Empire. Ratisbon owes its importance to its position at the terminus of the Brenner route. That of Genoa comprises the western part of the plains of Northern Italy, and then by the St. Bernard and Furka Passes with the upper Rhone Valley, and the valley of the upper Rhine with the towns of South Germany. Trade passed from both Venice and Genoa over the Maloja Pass to the valley of the Inn, and so into Austria. Ulm, the point at which the Danube becomes navigable, was reached from Genoa, and thus formed the connecting link between two very important trade routes.

Italy is making great strides in industries in spite of very heavy taxes. There is a good deal of water-power available, and this is being largely used for the production of electricity for use in the silk factories and other industrial establishments.

Arithmetic.

Study the chapters on Interest, both Simple and Compound, and Discount.

Algebra.

Students must be prepared to deal with questions of theory. The two test questions set last month were from Certificate Papers. The definition of H.C.F. is given in the text-books. The student should formulate his conceptions into definitions, which he should be able to write down at once. The next part of the question was easy enough for those who remember that every common factor of two expressions is a factor of their sum and of their difference. If $a^3 - 2a^2 - 9$ be subtracted from $a^3 - 6a - 9$ the remainder $2a^2 - 6a$, or $2a(a - 3)$ must contain all their common factors. Of the three factors 2, a, and $(a - 3)$, of this expression 2 is not a factor of either algebraical expression,

although it would be a factor of every numerical value of either if a were odd. Similarly a cannot be a factor of either, since neither 2 nor a will divide 9. Hence if there is a common factor it must be $a-3$. On dividing the two expressions by $a-3$ we obtain a^2+3a+3, and a^2+a+3 respectively. The principle stated above shows us that these are prime to one another, because their difference is $2a$, and neither expression is divisible by 2 or by a. Hence the L.C.M. is

$$(a^2+3a+3)(a^2+a+3)(a-3).$$

In dealing with the second question the factors of the expressions are most easily obtained by treating them as the difference of two squares.

$$a^4+a^2b^2+b^4=a^4+2a^2b^2+b^4-a^2b^2=(a^2+b^2)^2-(ab)^2$$
$$=(a^2+ab+b^2)(a^2-ab+b^2).$$
$$\text{And } a^4-a^2b^2+2ab^3-b^4=a^4-(a^2b^2-2ab^3+b^4)=(a^2)^2-(ab-b^2)^2$$
$$=(a^2+ab-b^2)(a^2-ab+b^2).$$

From this it will be seen that the only common factor is a^2-ab+b^2, and this is the H.C.F. The L.C.M. is

$$(a^2-ab+b^2)(a^2+ab+b^2)(a^2+ab-b^2).$$

Elementary Science.

We now begin the study of Part II. Probably the student has never set himself rigidly to test the differences between living and non-living matter. If he has he will have noticed that change and growth are the chief characteristic signs of life. Change, however, takes place in non-living things, but it differs in kind from the changes which accompany life; so also growth may occur in non-living things. A delta grows larger as matter is brought down to it by the river, and in a saturated solution a crystal may be seen to grow larger and larger. But in each of these cases the growth is due to the deposition of matter to the outside of the body, whereas in the case of a living being, whether animal or vegetable, the increase is brought about by material taken into the body and undergoing a change which makes it an integral part of the body. The division of living bodies into animals and plants is the next matter to consider. In the case of the higher examples few mistakes are possible. No one would think of calling a lion a vegetable or an oak tree an animal. The lion is able to move about, while the oak tree is fixed and rooted to one spot. But although movement is commonly regarded as "the cardinal function of animal life," we have cases on the other hand of animals that have no power of locomotion, while certain rudimentary plants can move from place to place. On looking a little more closely into the matter, we find two fundamental differences between animals and plants, one based on the microscopic structure and the other on the chemical changes brought about by them while they are alive. All bodies of animals and plants are made up of little masses of a substanced protoplasm. These little masses are called cells, and in the case of a vegetable cell we find there is always a distinct covering to the cell, which is made up of material different from that of the cell itself; while in the case of an animal cell, if there is any difference at all between the outer and inner parts of a cell, it is merely due to the hardening of the outer part. This difference might be illustrated by contrasting an apple dumpling with a loaf of bread; in the former case the crust is of different material from that which it surrounds, but in the latter it is merely a hardened form of the same material. Again, we find that chemical changes are constantly going on in the bodies of both animals and plants, but in the former case highly complex substances are taken in and broken up into simpler forms; thus complicated substances, such as sugar and gelatine, are taken as food, and their components are given off principally in the form of carbon dioxide and water. On the other hand, plants have the power of taking in carbon dioxide and water, and building up such bodies as starch, gum, and sugar. In no case has a plant a digestive cavity; all its nutriment must be taken in the soluble form. Even in the case of "carnivorous" plants, the flies, etc., which they catch are "digested" on the outside. We have said that every animal and plant consists of cells. The simplest animals and the simplest plants consist of only one cell, and this one cell has to perform all the functions of life—nutrition, locomotion, sensation, and reproduction; but in the higher animals and plants the cells are not only vastly more numerous, but they are arranged and developed on a principle of "division of labour," that is to say, some are modified so as to carry on the work of obtaining, preparing, and digesting the food, others are highly contractile and suited for the work of motion, others again are specially adapted to receive impressions from without or to continue the race of plants or animals. Parts of the body which are specially adapted to perform particular functions are called "organs," and creatures, or parts of creatures, which are provided with organs, are said to be "organised." The higher we advance in the scale of life the more highly organised do the creatures become, and, to use the phrase of Milne-Edwards, the greater is the "division of physiological labour."

As the student will have better opportunities of doing practical work in botany in the spring and summer, we shall proceed to that part of the syllabus that deals with animal life. The syllabus does not apparently expect a very detailed knowledge of the invertebrates, so we go on to the vertebrates, or backboned animals. The most important characteristic of the vertebrates is the possession of two separate cavities running the length of their bodies. The dorsal one, that is the one nearest the animal's back, is occupied by the cerebro-spinal nervous system. The other, the ventral, contains the organs of circulation and digestion. In the partition separating these two cavities are usually to be found a number of bones arranged in a chain and constituting the vertebral or spinal column. Judging by the name of the sub-kingdom, every member of it should have vertebræ, but one—the Amphioxus—although agreeing in other respects, has no real backbone. Some of the vertebrates have no jointed limbs, and none possess more than two pairs. These are always directed away from the side of the body on which the central nervous system is situated, and are provided with an internal skeleton to which the muscles are attached. If an *invertebrate* has a skeleton it is an external one—*e.g.* the lobster. The jaws of vertebrates are always parts of the walls of the head, and not modified limbs, as in the lobster, insects, etc., and their motion is in the direction of the axis of the body, not across. All vertebrates have a complete system of blood vessels. The limbs of vertebrates are joined to more or less complete bony girdles, the fore-limb to the pectoral arch or shoulder girdle, which consists in man of the blade-bones and collar-bones, and the hind limbs are attached to the pelvic girdle or hip-bones. We shall take the modification of limbs next month.

Circular 525.

CIRCULAR TO LOCAL EDUCATION AUTHORITIES, ETC. EXTRANEOUS DUTIES OF TEACHER

Board of Education,
Whitehall, London, S.W.,
27th November 1905.

Sir,—Some uncertainty appears to prevail among Managers of Voluntary Schools, and even among Local Education Authorities, as to the meaning of Article 15 (a) of the Code, which relates to the imposition upon a Teacher of duties extraneous to the work of the Public Elementary School, in which he is, or is desirous of being employed.

It is not uncommon to find either in the advertisement of the vacancy or in subsequent correspondence with applicants for the post, an intimation that the Teacher will be required to play the organ in Church, or teach in the Sunday School, or to perform some other duty unconnected with the work of the School. The Board think it necessary to remind Local Education Authorities and Managers that any such requirement is invalid, and that its enforcement may involve a refusal by the Board to recognise the Teacher, and further may even disentitle the School to further recognition as a Public Elementary School.

Such being the case, the Board think it desirable to warn School Managers that the continued recognition of the School Correspondent by whom the advertisement or intimation has been issued might be rendered impossible.

Even in cases where the discharge of extraneous duties is not made a condition of appointment, but is merely suggested to applicants as a means of increasing their income, it would be right that a Local Authority should satisfy themselves that educational qualifications have not been subordinated to a capacity and willingness on the part of the candidate to play the organ in Church, to teach at a Sunday School, or to undertake any other work not connected with the usual duties of a teacher of a Public Elementary School.

From various incidents which have occurred recently the Board think it desirable to impress upon Local Education Authorities and Managers the necessity for making the teaching capacity and the educational qualifications of the candidate the essential considerations in appointments to teaching posts in Public Elementary Schools.

I have the honour to be, sir, your obedient servant,

H. M. Lindsell.

OUR SCIENCE SECTION

☞ **Subscribers requiring Explanations of Difficulties in any branch of Science, or Advice upon Courses of Study, can obtain all help required by communicating with the Editor, and accompanying their query with the Coupon cut from this number.**

NOTES ON PHYSICS.

BY EDWIN EDSER, A.R.C.SC.

Author of "Heat for Advanced Students," "Light for Students," "Differential and Integral Calculus for Beginners," etc.

In these columns it is proposed to deal with problems in Physics which are not directly considered in text-books devoted to the several branches of Physics. It is believed that students, especially those preparing for the examinations of the University of London and other kindred universities, are often severely handicapped by the want of such information as it is our purpose to give. We shall be pleased to receive suggestions or information as to difficulties encountered by students, and these will be dealt with when practicable.

General Physics.

Two cylindrical vessels, one of section 100 sq. cms., the other 10 sq. cms., contain water and are connected together. The water is higher in the former than the latter by 100 cms. initially. How much heat is produced by the time that the water has come to rest after being allowed to flow from one vessel to the other?

Inter. Sci., London (Internal Students), 1905.

When the water has come to rest the surfaces in the two vessels will be level with each other; hence if the surface in the larger vessel sinks x cms., that in the smaller vessel will rise $(100-x)$ cms. Also the volume of water leaving the larger vessel is $100\times x$ c.cms., and that entering the smaller vessel is $(100-x)\times 10$ c.cms.; and since these volumes must be equal, we have

$$100x=10(100-x) \quad \therefore \quad x=9{\cdot}091 \text{ cms. (nearly).}$$

Hence volume of water leaving larger vessel $=909{\cdot}1$ c.cms., and this will have a mass of 909·1 grams (nearly).

The centre of gravity of the water which leaves the larger vessel was initially $9{\cdot}091/2=4{\cdot}545$ cms. above the final level of the surfaces in the two vessels; and since the surface in the smaller vessel rises $(100-9{\cdot}091)=90{\cdot}9$ cms. (nearly), the centre of gravity of the water which enters the smaller vessel is $90{\cdot}9/2=45{\cdot}45$ cms. below the final level of the surfaces. Hence the c.g. of the water transferred from one vessel to the other descends through $(45{\cdot}45+4{\cdot}54)=49{\cdot}99$ or (say) 50 cms. during the transference. The work done by gravity is therefore equal to

$$909{\cdot}1\times 981\times 50=4{\cdot}45\times 10^7 \text{ ergs.}$$

When the water has finally come to rest, the work done by gravity during the transfer has been converted into heat, every 42×10^6 ergs of work producing 1 heat unit. Hence $4{\cdot}45/4{\cdot}2=1{\cdot}06$ heat units are produced.

A stone is dropped down a pit shaft, and five seconds afterwards the sound of its striking the bottom is heard. Calculate the depth of the shaft, the temperature of the air in the shaft being 15° C.

Velocity of sound in air at 0° C = 333 metres per second.
Coefficient of expansion of air = 1/273.

Inter. Sci., London (Internal Students), 1905.

If we neglect the effects of the friction of the air on the body, the depth s of the shaft is given by the equation

$$s=\tfrac{1}{2}gt^2,$$

where t is the time which elapses between the release of the stone and its arrival at the bottom of the shaft. At the instant the stone reaches the bottom a sound-wave is generated, and this wave travels at a uniform velocity V, and reaches the orifice of the shaft 5 seconds after the stone was released, *i.e.* in $(5-t)$ seconds after the stone strikes the bottom. Therefore, since $V=s/(5-t)$, we have

$$\frac{\tfrac{1}{2}gt^2}{5-t}=V \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

The velocity V of sound in air varies inversely as the square root of the density of air, and the density varies inversely as the absolute temperature of the air; hence the velocity of sound varies directly as the square root of the absolute temperature of the air, so that

$$\frac{\text{Velocity at } 15^\circ \text{ C.}}{\text{Velocity at } 0^\circ \text{ C.}}=\sqrt{\frac{273+15}{273}}=\sqrt{1{\cdot}055}=1{\cdot}027 \text{ (nearly).}$$

$\therefore$ Velocity at 15° C. $=1{\cdot}027\times 333=342$ metres per second.

(The same result could have been obtained more simply from the law that the increase in the velocity of sound for each degree rise of temperature in the gas is equal to 0·6 metres per second.)

Thus from (1),

$$\frac{\frac{981}{2}\cdot t^2}{5-t}=34200 \text{ cms. per sec.}$$

$$\therefore \quad t^2+69{\cdot}7t=348{\cdot}5.$$

$$\therefore \quad t=-34{\cdot}8\pm\sqrt{348{\cdot}5+(34{\cdot}8)^2}=-34{\cdot}8\pm 39{\cdot}49.$$

Since t cannot be negative, the root of this equation with the positive sign prefixed to the radical is the one we want; hence

$$t=39{\cdot}49-34{\cdot}8=4{\cdot}69 \text{ secs.}$$

$$\therefore \quad s=\frac{981}{2}\times(4{\cdot}69)^2=1075 \text{ cms., or } 10{\cdot}75 \text{ metres.}$$

Heat.

The temperature of the air being 15° C., and the hygrometric state 0·65, what is the dew-point?

	Cms. of Mercury.
Maximum pressure of water vapour, at 5° C.	= 0·65
" " " " " 10° C.	= 0·92
" " " " " 15° C.	= 1·27

Inter. Sci., London (Internal Students), 1905.

The air contains 0·65 of the mass of water vapour per c.c. that would saturate it, and therefore the pressure of the water vapour is $0{\cdot}65\times 1{\cdot}27=0{\cdot}825$ cms. of Hg. If the air is cooled down till we reach the temperature at which the maximum pressure of water vapour is equal to 0·825, then this temperature will be the dew-point. From the data given, a curve should be plotted on squared paper, temperatures being taken as abscissæ, and maximum pressures of water vapour as ordinates; it will then be found that the maximum pressure of water vapour is equal to 0·825 at 8·5° C.; therefore the dew-point is equal to 8·5° C.

How does the intensity of solar radiation depend on the angle of incidence? On 22nd June a vertical rod at Calcutta

casts no shadow at noon, but on the same date and time of day a rod 4 ft. long casts a 3 ft. shadow at Christiania. Compare the intensity of solar radiations at these places, allowing merely for difference of latitude.

Inter. Sci., London (*Internal Students*), 1905.

The intensity of solar radiation is the energy received from the sun per unit area of the earth's surface per second. If we suppose a pencil of sunlight of unit sectional area to fall normally on the surface of the earth (as, in the question, it is stated to do at Calcutta on 22nd June), then the energy comprised in a length of the pencil equal to the velocity of light, V, will fall on unit area of the earth's surface in one second. If, however, this light fall on a surface of which the normal is inclined at an angle θ to the direction of the rays, then the pencil of unit cross sectional area will intersect the surface in an area equal to $1/\cos\theta$, and therefore the energy of the pencil will be distributed over this area ($1/\cos\theta$), and the energy received by unit surface will be found by dividing that in a length V of the pencil of unit sectional area by $1/\cos\theta$. Hence the intensity of solar radiation received varies directly as $\cos\theta$. At Calcutta, on 22nd June, $\cos\theta = 1$. A vertical rod, which is normal to the earth's surface, casts no shadow, and therefore the sun's rays are parallel to the normal to the earth's surface.

At Christiania a rod 4 ft. long casts a shadow 3 ft. long. Hence, $\cos\theta = 4/(4^2+3^2)^{\frac{1}{2}} = 4/5$. Hence the intensity of solar radiation at Christiania is equal to 4/5 of that at Calcutta.

Light.

An observer looking with one eye perpendicularly through the large face of a glass prism which is supposed to have angles of 90°, 45°, and 45°, sees the pupil widened when the prism is a foot or so away, but just double when it is held at arm's length. What inference should he draw as to the large angle of the prism?

B.Sc. Pass, London (*External Students*), 1903.

This is a problem on the formation of images by multiple reflections in two plane mirrors inclined to each other. Let OM_1, OM_2 (Fig. 1), represent the traces on a horizontal plane of

FIG. 1.

two mirrors which are inclined to each other at an angle nearly equal to 90°, the mirrors themselves (of which the sections are represented by the continuous lines) being perpendicular to the plane of the paper. Let AB represent the section of the pupil (indicated by an arrow in order to distinguish between its two sides) placed on the bisector of the angle M_2OM_1; and let the angle $M_2OM_1 = 2\alpha$, while AB subtends an angle 2β at O. The method of finding the various images formed by multiple reflections in the mirrors OM_1 and OM_2 is explained in *Light for Students*, pp. 24–25. Describe a circle with O as centre, and OA or OB as radius; measure off the angle $A_1OM_1 = AOM_1$, then A_1, a point on the circle, will be the image of A formed by a single reflection in OM_1. The corresponding image B_1 of B is found in an similar manner. The image A_1B_1 will give rise to a second image $A_{12}B_{12}$ by reflection in OM_2; the angle $A_{12}OM_2$ must be made equal to the angle A_1OM_2, and B_{12} is determined in a similar manner. A_2B_2 is the image of AB formed by a single reflection in OM_2, and this image gives rise to the second image, $A_{21}B_{21}$, by reflection in OM_1.

According to the question, a double image of the pupil is formed when the prism is held at arm's length; that is, the two images $A_{12}B_{12}$ and $A_{21}B_{21}$ just touch each other, as in Fig. 1. Now $A_1OM_1 = AOM_1 = \alpha - \beta$, and therefore $A_{12}OM_2 = M_2OA_1 = 2\alpha + \alpha - \beta$; therefore angle $A_{12}OB_{12} = 180° - (2\alpha + \alpha - \beta + \alpha) = 180° - 4\alpha + \beta$. But according to the question, angle $A_{12}OB_{12} = 2\beta$; thus—

$$180° - 4\alpha + \beta = 2\beta$$

$$\therefore 4\alpha = 180 - \beta, \text{ and } 2\alpha = 90° - \frac{\beta}{2}$$

Thus the large angle of the prism, 2α, is slightly less than a right angle.

An estimate of the actual value of 2α can easily be formed. Assume that the width of the pupil is 0·4 cms., and that the prism is held at a distance of 55 cms. from the eye. Let the refractive index μ of the glass be equal to 1·5; then in determining the value of the angle 2β, we must remember that the light which passes into the prism is refracted, and this forms an image of the pupil of unaltered size, but at a distance $\mu \times 55 = 1{\cdot}5 \times 55 = 82$ cms. from the angle O; the distance from the larger face of the prism to the angle O is neglected. Hence the circular measure of the angle 2β is equal to

$$\frac{0{\cdot}4}{82} = 0{\cdot}0049;$$

hence since the circular measure of 180° = 3·14, the angle 2β, measured in degrees, will be equal to

$$\frac{0{\cdot}0049}{3{\cdot}14} \times 180 = 0{\cdot}28°,$$

$$\therefore \frac{\beta}{2} = \frac{0{\cdot}28}{4} = 0{\cdot}07°,$$

and the large angle of the prism is approximately equal to

$$90° - 0{\cdot}07° = 89{\cdot}93°.$$

At a depth of some metres in a smooth sea, the appearance is said to be that of surrounding dark walls and a clear circular illuminated region above. Explain this appearance, and discuss the effect on it of (*a*) ripples, (*b*) a heavy sea.

How would the appearance be modified if the view were taken from inside a submarine boat, looking up through a flat horizontal plate of glass?

B.Sc., London, Pass (*External Students*), 1902.

Let E (Fig. 2) be a luminous point at a distance EA below the surface of water. Let the broken lines indicate rays radiating from E, and falling on the surface. A ray which emerges

FIG. 2.

into the air above the water will be inclined to the normal to the surface at such an angle that its sine is μ times the sine of the angle which the corresponding ray in the water makes with the normal. A ray EB in the water will give rise to an emergent ray travelling just along the surface of the water if

$$\mu \times \sin BEA = 1.$$

Thus $\sin BEA = 1/\mu = 1/1{\cdot}33$ (the value of μ for water being 1·33), and $\angle BEA = 49°$ nearly. Rays from E, inclined to the vertical AE at angles greater than 49°, will not be transmitted into the air, but will be totally reflected at the surface.

Now suppose the directions of all the rays to be reversed. The various broken lines will now represent the rays of light from a bright sky which reach the point E, and it becomes

obvious that no ray will reach E inclined at an angle greater than BEA = 49°. Hence the appearance presented to an eye immersed in the water at E will be that of a bright circular disc vertically above E, the radius of this disc being AB; the diameter of the bright disc will subtend an angle $2 \times 49 = 98°$ at E. Since no ray inclined at an angle greater than BEA can reach E, it follows that outside the circle of radius AB there will be complete darkness, and the appearances will be that of perfectly black cylindrical walls with a circular opening of radius AB above. Since the value of μ for blue rays is greater than that for red rays, the angle BEA will be slightly smaller for blue than for red rays; hence the circular disc will have a larger diameter for red than for blue rays, and the bright central disc will shade off into a narrow rim of red at the edge.

Now suppose ripples to travel from right to left along the diameter BAB, the crests of these ripples lying at right angles to the plane of the paper. Just within the bright disc, rays from the sky will be unable to reach E through the sides of the ripples sloping towards A; so that there will be patches of darkness (each surrounded by a narrow red rim) within the bright disc. With very small ripples these patches of darkness will be confined to the outer part of the bright disc, but as the size of the ripple increases the dark patches will approach nearer and nearer to the point A.

Outside the bright disc, light rays will be able to reach E through those sides of the ripples which slope away from A; thus when the ripples are small there will be bright patches (each surrounded by a narrow red rim) outside the central bright disc; and the larger the ripples, the farther will these bright patches be found from the edges B, B, of the central bright disc. In a heavy sea, the whole of the surface will present the appearance of moving patches of light of varying shapes and dimensions.

If the view were taken from the interior of a submarine boat, looking upwards through a flat horizontal plate of glass, the above appearances would not be presented. The whole surface would appear bright, since the view would be through a slab of water with plane parallel sides: if ripples or waves were present the whole of the surface would appear bright, mottled by dark shadows.

Electricity and Magnetism.

A copper ring is hung by a torsionless thread between the vertical parallel and flat opposed faces of an electro-magnet. The plane of the ring is vertical, and is inclined at 45° to that of either pole face. If a current is started round the magnet, the ring turns through a moderate angle, but quickly comes to rest. If it is replaced in its former position, and the current is stopped, it starts twisting in the opposite direction, and keeps on spinning. Account for these actions.

B.Sc. Final, London (External Students), 1902.

Let the pole faces be vertical, with their planes in the meridian, the one which is N. when the electro-magnet is excited being to the E. of the ring. Let the vertical plane of the ring extend in a N.E. to S.W. direction. Then, on exciting the magnet, lines of force are introduced into the ring; an anti-clockwise E.M.F. will be induced in the ring, looking along the lines of force, *i.e.* from E. to W., and thus a current will flow *up* the N.E. side of the ring and *down* the S.W. side. Applying the ordinary rules for the reaction of a magnetic field on a conductor carrying a current, it is easily seen that the ring will begin to twist in a clockwise direction when viewed from above. But, when the magnetic field has been established, the twisting of the ring will cause it to cut the lines of force of the field, and a current will be induced in the ring in such a direction that the motion of the ring will be opposed (Lenz's Law); hence the ring will rapidly come to rest. If a current is induced in the ring by virtue of its motion, then this current will produce heat in the ring, and this heat can only be generated at the expense of the kinetic energy which would otherwise tend to keep the ring rotating.

On replacing the ring in its former position and breaking the circuit of the magnetising current of the magnet, the field of the magnet will be abolished, and the lines of force will be removed from the ring; consequently, looking along the lines of force, a clockwise E.M.F. will be generated in the ring, and a current will flow *down* the N.E. side and *up* the S.W. side of the ring. The reactions of these currents will set the ring rotating in an anti-clockwise direction as viewed from above. When the field has disappeared the ring will no longer cut any lines of force, so that no current will be induced to it, and no reactions tending to stop it will be produced; hence it will continue to rotate until the kinetic energy has been exhausted in overcoming the friction of the air, etc.

A bicycle with a front wheel of radius 65 cms. is travelling at the rate of 20 kilometres per hour in a direction magnetic east and west. A wire attached to the front fork grazes the rim of the wheel. Calculate the E.M.F. in the circuit consisting of the wheel, wire, and the fork; given H = 0·18.

Inter. Sci. London (International Students), 1905.

The motion of the wheel is made up of (*a*) a translatory motion without rotation, and (*b*) a rotation. The resultant E.M.F. in the specified circuit will be the algebraic sum of the E.M.F.'s severally generated by virtue of (*a*) and (*b*).

(*a*) *E.M.F. due to Translatory Motion.*—Let us suppose that a spoke of the wheel lies between the two branches of the fork. Both the spoke and the fork will cut the same number of lines of force per second, and therefore equal E.M.F.'s will be generated in the two; but as these E.M.F.'s oppose each other in the circuit *spoke, rim, fork*, no resultant E.M.F. will be produced owing to the bodily translation (without rotation) of the wheel. This is an example of the general theorem that no resultant E.M.F. is generated in a closed circuit which is moved without rotation in a uniform magnetic field.

(*b*) *E.M.F. due to Rotation.*—The E.M.F. generated in a conductor which cuts a magnetic field is equal to the number of C.G.S. lines of force cut per second. Now the wheel is travelling in an east and west direction; hence any spoke, during a single rotation of the wheel, will cut as many lines of force of the earth's horizontal field as are enclosed by the circular rim of the wheel, *i.e.* the number of lines of force cut per second will be equal to $\pi r^2 n H$, where r is the radius of the wheel, and n is the number of complete rotations per second. Also, while the wheel makes one complete rotation, it will travel onwards through a distance equal to the circumference of the wheel; hence, since the wheel travels through a distance of $(20{,}000 \div 3600) = 50/9$ cms. per second, and the circumference of the wheel is equal to $2\pi r$ cms., it follows that $n = \dfrac{50}{18\pi r}$.

The number of lines of force enclosed by the rim of the wheel $= \pi r^2 H$, and these lines of force are cut n times per second, hence

$$\text{E.M.F.} = \frac{\pi r^2 H \times 50}{18\pi r} = \frac{50 r H}{18} = \frac{50 \times 65 \times 0{\cdot}18}{18} = 32{\cdot}5 \text{ C.G.S. units.}$$

To bring the E.M.F. to volts it must be divided by 10^8; its value then becomes equal to $3{\cdot}25 \times 10^{-7}$ volt.

CHEMISTRY.

(ADVANCED AND HONOURS.)

BY C. A. WEST, B.SC., A.R.C.S., F.I.C.

ELECTROLYSIS.

WHEN a current of electricity is sent through a platinum wire, the latter becomes endowed with new properties. It becomes surrounded by magnetic lines of force, which are able to deflect a magnetic needle placed near.

If the current is made strong enough, the wire becomes white hot and gives out light. In any case it becomes heated to an extent depending on the strength of the current. The change, however, is a physical one, and when the current is switched off the wire seems to be just the same as it was before. Now cut the wire in two, and connect one piece to the positive terminal of a battery and the other to the negative terminal. Dip the two free ends into a solution of copper sulphate.

If a galvanometer be included in the circuit, it will be found that a current flows, and it will be observed that bubbles of gas rise from the wire connected to the positive terminal of the battery, while at the same time a red deposit of copper is formed on the wire connected to the negative terminal. We see, then, that in this case the liquid acts as a conductor, but at the same time there is a distinct change taking place in the liquid.

Substances like the copper sulphate, which act as conductors, but are at the same time separated into their components, are called *electrolytes*, and the portions into which their molecules are separated are called *ions*. This name is derived from the

Greek word *ιων*, meaning a wanderer, and was given to them by Faraday, because they seemed to wander or travel about in the liquid. The metallic wires, plates, or other conductors used for conducting the current into and out of the cell are called *electrodes*. The electrode by means of which the current enters the cell is called the *positive electrode* or *anode*.

The electrode by means of which the current leaves the cell is called the *negative electrode* or *cathode* (sometimes spelled kathode). The name *anion* is given to the ion which travels to the anode, and the name *cathion* (or kation) to the ion which travels to the cathode.

This process of the separation of a substance into two or more constituents by the passage of an electric current is spoken of as *electrolysis*.

By means of electrolysis quite a number of metals have been extracted from their salts. It was by means of the electrolysis of their fused hydroxides that Sir Humphrey Davy first isolated sodium and potassium, and demonstrated their metallic properties. Many other metals may be isolated from their compounds in the same way. It is quite an easy matter to prepare metallic lithium and magnesium by the electrolysis of their fused chlorides. The metal calcium is prepared in this way, and nearly all the aluminium employed commercially is prepared by the electrolysis of the fused oxide. The number of *pure* substances which readily allow electrolytic conduction to take place through them, however, is comparatively small. A very large number of substances, however, when dissolved in water or other liquids, act as electrolytes.

A very large number of experiments have been carried out with solutions of salts in water, and many of them are found to give solutions which conduct comparatively freely, although water itself can scarcely be classed as a conductor.

Ordinary water conducts fairly readily, but this is because of the substances dissolved in it. Drinking water ordinarily contains carbonic acid and other gases in solution, in addition to dissolved solids. Ordinary distilled water, as used in chemical laboratories, is never pure. In fact, it is questionable whether water has yet been obtained in a pure state. Elaborate experiments have been carried out with a view to obtaining pure water, so as to determine what its electrical conductivity really is.

The water is distilled with potassium permanganate and dilute sulphuric acid to destroy organic matter. The acid at the same time holds back any dissolved bases. The water is then again distilled with barium hydrate or other basic substance, to remove traces of volatile acids, and the final distillation should be conducted in an apparatus made of platinum. It is necessary also to keep the water from contact with the air, otherwise it absorbs carbon dioxide and other gases from it.

It will be remembered that glass (and especially soft glass) is attacked by water to some extent, and this is the reason for using platinum apparatus for the final distillation.

Experiment shows that water thus purified is a very bad conductor.

Pure hydrochloric acid is also a bad conductor, yet if we dissolve a little hydrochloric acid in water we get a solution which allows electricity to flow through it quite freely. Some change then apparently takes place when we bring the water and the acid together. We may dissolve hydrochloric acid in a bad conductor, such as chloroform, without getting a solution capable of conducting electricity freely.

The solvent used then affects the result. Methyl and ethyl alcohols and acetone give solutions which conduct, but they do not act so well as water solutions.

The solutes which give good conducting solutions are practically all mineral acids, bases, or salts. Substances like alcohol, urea, starch, benzene, sugar, etc., and a great many organic substances, do not form good conducting solutions, and are therefore not classed as electrolytes.

Electrolytes vary very much amongst themselves with regard to their conducting powers, strong acids like nitric acid and hydrochloric acid conducting much more freely than weak acids like acetic acid and benzoic acid.

Strong bases like sodium and potassium hydroxides conduct much better than weak bases like hydrazine.

The conductivity of a salt depends upon the acid and basic radicals from which it is formed. A salt formed from a weak base and a weak acid is a poor electrolyte.

A salt formed from a strong acid and a weak base or from a weak acid and a strong base acts better, while a salt formed from a strong acid and a strong base gives a typical case of a good electrolyte.

PHYSIOGRAPHY.

(STAGES 2 AND 3.)

THE THERMOMETER (*Continued*).

ANOTHER form of electrical thermometer now largely used for industrial purposes on the Continent, and also to a certain extent in England, is the thermo-electric thermometer. Take a piece of iron wire and a piece of copper wire, and connect one end of one of them to one terminal of a delicate galvanometer (such as that illustrated in the November number of the *Practical Teacher*, p. 271), and connect one end of the other wire to the other terminal. Then join the free ends of the wires together by twisting them round each other. Now, by means of a match, heat the junction of the two metals, and it will be found that the needle of the galvanometer is deflected through a considerable angle. This is because an electric current is produced in the circuit by the difference in temperature of the joined ends of the wires and the ends connected to the terminals of the galvanometer. Also try the following experiment: Keeping the wires still connected to the galvanometer, cool the ends which are twisted together by dipping them into iced water so that their temperature is below the temperature of the other ends. The needle of the galvanometer will again be deflected, but in a direction opposite to that in which it was deflected before, showing that again a current has been produced, but this time in the reverse direction.

What we have proved to be true for copper and iron has been found by experiment to be true for all metals. All that is necessary to produce a current is to take a junction of two different metals, complete the circuit by connecting the other two ends together, and make the temperature of the two junctions different. It does not matter whether the other two ends of the wires are connected together directly or through a galvanometer, but of course for our purpose it is best to include a galvanometer in the circuit, so that we get some indication of what is happening.

Currents produced in this way by differences in temperatures are called *thermo-electric currents*, and a pair of metals so arranged as to produce such a current is spoken of as a *thermo-couple*.

The current produced by means of a thermo-electric couple varies with the difference in the temperatures of the two junctions, and that in a very regular way. It is found, however, that couples give different values for the same differences

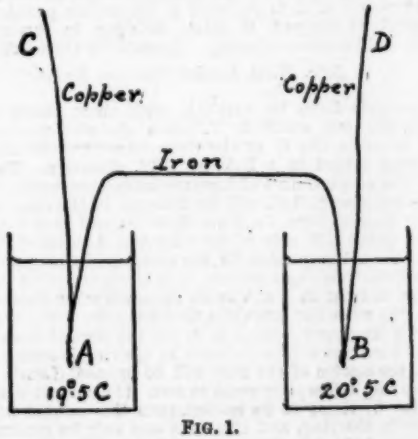


FIG. 1.

in temperature, and before we can make much use of thermo-couples we must learn more about them.

Instead of dealing with the currents produced by the couples, it is better to deal with the differences in electrical potential or pressure produced at the two junctions by the difference in temperature before the circuit is completed.

The maximum difference in potential for any given couple and given difference in temperature is produced when the circuit is not completed. As soon as we allow the current to flow, this tends to make the potential difference less, and the strength of the current, and its consequent effect on the potential difference, varies with the resistance in the circuit.

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The maximum potential difference for the given conditions is obtained when no current is allowed to flow. This difference in potential can be shown to exist and can be measured, but we shall not go into the method of doing this. This maximum difference in potential is called the *electro-motive force* or E.M.F. of the couple. The greater the difference in the temperatures of the two junctions, the greater as a rule is the E.M.F.

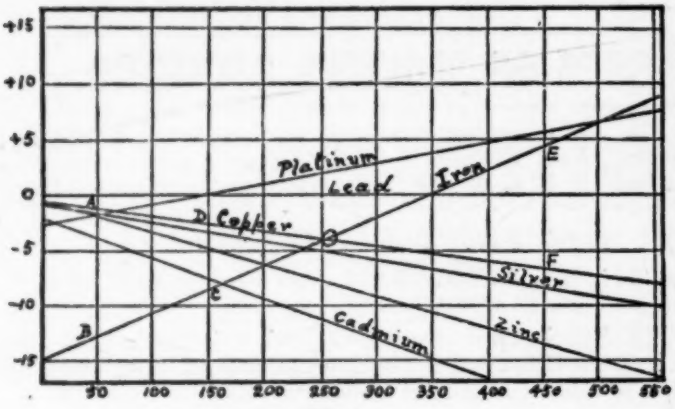

FIG. 2.

When the difference in temperature is 1° C., the E.M.F. is spoken of as the *thermo-electric power* of the couple at their mean temperature.

An example will make the meaning of this term quite clear. Suppose we take a piece of copper wire and a piece of iron wire and twist them together at the two ends, and then cut the copper wire in halves and bend the wire as shown in Fig. 1, and dip the junction A into a beaker of water at 19·5° C. and B into another beaker of water at 20·5° C. The free ends C and D of the two copper wires will be at different potentials, and the potential difference is the thermo-electric power of the couple at 20° C. If the two ends C and D are connected to a galvanometer, a current flows through the circuit, flowing in the direction from B to A through the iron wire. This current gives an indication of the potential difference, but it at the same time tends to equalise the potentials of the two junctions, making the difference somewhat less than the thermo-electric power. The less the resistance of the circuit the stronger the current.

There is, however, always a definite relation existing between the available electro-motive force, the resistance of the circuit, and the strength of the current produced. This relation is expressed by Ohm's law thus: *The current produced in an electric circuit is numerically equal to the ratio of the electro-motive force to the resistance of the circuit.* The current is measured in ampères, the electro-motive force in volts, and the resistance in ohms. This law may be expressed in symbols thus—

$$\text{C (in ampères)} = \frac{\text{E (in volts)}}{\text{R (in ohms)}}.$$

So long as the resistance of the circuit remains practically constant, the current is directly proportional to the electro-motive force. Hence, if the resistance of the galvanometer is high, so that the changes in the resistance of the thermo-couple due to change in temperature are very small in comparison, we may assume that the resistance of the circuit remains sensibly constant. Under these conditions, then, we may take the currents as being proportional to the E.M.F.'s, and this enables us to compare the E.M.F.'s for various differences in temperature.

For the purpose of comparing the various metals with each other, lead has been chosen as the standard metal with which all others are compared, and the results of a large number of experiments have been expressed in the form of a diagram suggested by Lord Kelvin, and shown in Fig. 2.

Along the horizontal axis are plotted temperatures Centigrade, and along the vertical axis thermo-electric powers expressed in microvolts (a microvolt is $\frac{1}{1000000}$ of a volt). Such a diagram, constructed for various metals compared with lead, also enables us to compare any two of the metals with each other without further experiment. Suppose, for instance, we require to know the thermo-electric power at 500° C. of a couple composed of iron and copper, we find from the diagram that at this temperature this is about thirteen microvolts, and the current will pass through the hot junction from iron to copper, for the iron line is about *thirteen units above* the copper line on the diagram at this temperature. Let us now read off the thermo-electric power for the same couple at 50° C. We now find that the copper line is the higher by about twelve microvolts, and the current will flow through the hot junction from the copper wire to the iron.

At about 260° C. we find the iron and copper lines meet in a point. This tells us that at this temperature their thermo-electric powers as compared with lead are equal. Hence, if one junction of the iron-copper couple is half a degree above this temperature, and the other half a degree above, no current is produced at all. This temperature is called the *neutral point* for the couple.

Now, it will be observed that all the lines in the diagram are straight lines, and this gives us an easy method of calculating the E.M.F. produced by any pair of metals shown in the diagram for any two temperatures. The E.M.F. is obviously given by the area enclosed by the lines for the two metals and the two temperature lines; for instance, the E.M.F. due to an iron-copper couple between the temperatures of 50° C. and 150° C. is given by the area ABCD. This is 100 degrees multiplied by the mean of the two lines AB and CD. These measure 12 and 6 units respectively on the vertical scale. Their mean is 9, and the E.M.F. therefore $9 \times 100 = 900$ microvolts. The current will be from copper to iron through the hot junction.

If the two temperatures selected are on opposite sides of the neutral point, we must subtract the areas enclosed. Let us calculate the E.M.F. for the same couple between 150° C. and 450° C. In this case we must subtract the area CDO from the area EFO.

$$\text{EFO} = \frac{\text{EF}}{2} \times (450 - 260) = \frac{10}{2} \times 290 = 1450.$$

$$\text{CDO} = \frac{\text{CD}}{2} \times (260 - 150) = \frac{6}{2} \times 110 = 330.$$

The difference = 1120 microvolts, and the current will be from the iron to the copper through the hotter junction.

It will be obvious that keeping the temperature of one junction constant, and keeping the temperatures of both junctions on the same side of the neutral point, the E.M.F. will vary regularly with the temperature, and on this is based the method of measuring temperatures by means of thermo-electric thermometers or pyrometers.

(To be continued.)

MATHEMATICS.

(STAGES 2 AND 3.)

BY FRANK CASTLE, M.I.M.E.,

Royal College of Science; Lecturer on Mathematics, etc., Morley College; Author of "Elementary Practical Physics," "Practical Mathematics," etc.

Equations.—Probably one of the greatest difficulties met with in algebra is to express clearly and algebraically the data of even a simple problem. Any text-book on algebra will furnish exercises which may be used for this purpose. In addition, examples of simple or quadratic equations are, if necessary, easily manufactured, assuming simple and necessary data, then afterwards to proceed to solve these by the usual processes.

It is probably unnecessary to do more than suggest these simple methods, and to proceed to insert typical questions which will indicate some of the various and important methods which may be used in the solution of equations.

Ex. 1. (*a*) Find two consecutive odd numbers whose sum is half the sum of 15 and 17.

(*b*) Find the condition that must be fulfilled by three consecutive odd numbers, when their sum equals three times the sum of three other consecutive odd numbers. (1904)

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(*a*) Let $2n-1$ and $2n+1$ denote the two consecutive odd numbers.

The sum is $2n-1+2n+1$.

$$\therefore\ 2n-1+2n+1=(15+17)\div 2.$$

$$\therefore\ 4n=16 \text{ or } n=4.$$

Hence the required numbers are 7 and 9.

(*b*) Let $2n-1$, $2n+1$, $2n+3$ denote the first set of the three odd numbers, and $2n-1$, $2n+1$, $2n+3$ the second set, then as the sum of the former is three times that of the latter we obtain the relation

$$2n-1+2n+1+2n+3=3(2n-1+2n+1+2n+3)$$

$$\text{or } 6n+3=18n+9.$$

$$\therefore\ 2n+1=6n+3=3(2n+1).$$

Hence the necessary condition is that the middle term of first set must be three times the middle term of second set.

Ex. 2. A man lays out £26 in coals; he finds that the price is raised 6*s.* 6*d.* per ton, and consequently that he gets 4 tons fewer than he had expected; find the advanced price of coals per ton. (1901)

Let x denote the advanced price of coals per ton (in shillings).

Then number of tons obtained $=\frac{26\times 20}{x}$.

Also number of tons he expected to obtain $=\frac{26\times 20}{x-6{\cdot}5}$.

$$\text{Hence } \frac{26\times 20}{x-6{\cdot}5}-\frac{26\times 20}{x}=4$$

$$\text{or } 130\left(\frac{1}{x-6{\cdot}5}-\frac{1}{x}\right)=1.$$

$$\therefore\ 845=x^2-6{\cdot}5x.$$

$$x^2-\left(\frac{13}{2}\right)x+\left(\frac{13}{4}\right)^2=845+\frac{169}{16}=\frac{13689}{16}.$$

$$\therefore\ x=\frac{13}{4}\pm\frac{117}{4}$$

$$=32{\cdot}5 \text{ or } -26.$$

Hence the advanced price is 32·5*s.*, or £1, 12*s.* 6*d.*

Ex. 3. A person has invested some money in a 4½ per cent. stock; if the price of £100 of stock had been £17 less than what he paid, he would be receiving 1¼ per cent. more for his money than he receives in fact. Find at what price he bought the stock. (1902)

Let x denote the price at which he bought the stock.

$$\text{Then } £x \text{ produces } 4\tfrac{1}{2} \text{ or } \frac{17}{4}$$

$$\text{and } £100 \text{ produces } \frac{1700}{4x}$$

In the second case $£(x-17)$ produces 4½.

$$\therefore\ £100 \text{ produces } \frac{1700}{4(x-17)}.$$

$$\text{Hence } \frac{1700}{4(x-17)}-\frac{1700}{4x}=1\tfrac{1}{4}=\frac{5}{4}.$$

From this x is found to be 85.
∴ price of stock is £85.

Ex. 4. A man cannot afford to spend more than £18 a week in paying labourers; after a time he finds that he has to pay each labourer 6*d.* a day more, and so is obliged to dismiss four of them; find how many labourers he employed at first. (1902)

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Ex. 5. A man went to market with £15 to lay out in oats; he found that he had to pay 2*s.* 6*d.* a sack more than he had expected, and consequently came home with 10 sacks fewer than he had expected. Find how many sacks of oats he bought, and what he paid for each. (1903)

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Ex. 6. A man having a distance of 26 miles to walk, starts at a certain pace, and after walking at that pace for an hour reduces his pace by a mile an hour; in consequence he takes an hour and a half longer on his journey than he would have taken if he had kept up his first pace; find the pace with which he started. (1905)

Ans. 4½ miles per hour.

Ex. 7. A specimen of bronze consisted of 85 per cent. of copper, 10 per cent. of zinc, and 5 per cent. of tin; whilst a specimen of bell metal contained copper and tin only. The two specimens were fused together, and the mixture was found to contain 84 per cent. of copper, 8 per cent. of zinc, and 8 per cent. of tin. Find the proportion of copper and tin in the bell metal. (1904)

Ans. 80 per cent. of copper, 20 per cent. of tin.

Ex. 8. A man buys a certain number of articles for £2, 2*s.*, and obtains £2, 5*s.* by selling all but 24 at a penny a piece more than they cost; how many did he buy? (1899)

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Ex. 9. A number of men are first formed into a solid square, and afterwards into a hollow square four deep; the front presented in the latter formation has a hundred men more than the front in the solid square; find the number of men. (1900)

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Show that $\theta = 4\cos^{-1}\left(\frac{\sqrt{9+4n^3}-1}{4}\right)$.

(Minchin's *Statics.*)

Let p and q represent the magnitudes of the two given forces, and r the magnitude of the resultant. Then by the parallelogram of forces we have

$$p^2+q^2+2pq\cos\theta = r^2 \quad . \quad . \quad . \quad . \quad (1)$$

$$n^2\left(p^2+q^2+2pq\cos\frac{\theta}{2}\right) = r^2 \quad . \quad . \quad . \quad . \quad (2)$$

$$n^4\left(p^2+q^2+2pq\cos\frac{\theta}{4}\right) = r^2 \quad . \quad . \quad . \quad . \quad (3)$$

Dividing (1) by (2) we have

$$\frac{p^2+q^2+2pq\cos\theta}{p^2+q^2+2pq\cos\frac{\theta}{2}} = n^2;$$

$$\text{therefore} \quad \frac{\frac{p^2+q^2}{2pq}+\cos\theta}{\frac{p^2+q^2}{2pq}+\cos\frac{\theta}{2}} = n^2.$$

Denoting $\frac{p^2+q^2}{2pq}$ by k^2, the last equation becomes

$$\frac{k^2+\cos\theta}{k^2+\cos\frac{\theta}{2}} = n^2 \quad . \quad . \quad . \quad (4)$$

Similarly, by dividing (2) by (3), we obtain the equation

$$\frac{k^2+\cos\frac{\theta}{2}}{k^2+\cos\frac{\theta}{4}} = n^2 \quad . \quad . \quad . \quad (5)$$

From (4) we have $k^2(n^2-1) = \cos\theta - n^2\cos\frac{\theta}{2}$;

and from (5) we have $k^2(n^2-1) = \cos\frac{\theta}{2} - n^2\cos\frac{\theta}{4}$.

Hence $\cos\theta - n^2\cos\frac{\theta}{2} = \cos\frac{\theta}{2} - n^2\cos\frac{\theta}{4}$;

$$\therefore \quad \cos\theta - \cos\frac{\theta}{2} = n^2\left(\cos\frac{\theta}{2}-\cos\frac{\theta}{4}\right);$$

$$\therefore \quad 2\sin\frac{3\theta}{4}\sin\frac{\theta}{4} = 2n^2\sin\frac{3\theta}{8}\sin\frac{\theta}{8};$$

$$\therefore \quad 4\sin\frac{3\theta}{8}\cos\frac{3\theta}{8}\sin\frac{\theta}{8}\cos\frac{\theta}{8} = n^2\sin\frac{3\theta}{8}\sin\frac{\theta}{8};$$

$$\therefore \quad 4\cos\frac{3\theta}{8}\cos\frac{\theta}{8} = n^2;$$

$$\therefore \quad 2\left(\cos\frac{\theta}{2}+\cos\frac{\theta}{4}\right) = n^2;$$

$$\therefore \quad 2\left\{2\cos^2\frac{\theta}{4}-1+\cos\frac{\theta}{4}\right\} = n^2;$$

$$\therefore \quad 4\cos^2\frac{\theta}{4}+2\cos\frac{\theta}{4}-(2+n^2) = 0;$$

$$\therefore \quad 4\cos\frac{\theta}{4} = -1 \pm \sqrt{\{1+4(2+n^2)\}}.$$

Since $\frac{\theta}{4}$ must be a positive angle less than $\frac{\pi}{2}$, the upper sign must be taken.

$$\therefore \quad \cos\frac{\theta}{4} = \frac{\sqrt{9+4n^3}-1}{4};$$

$$\text{or} \quad \theta = 4\cos^{-1}\left(\frac{\sqrt{9+4n^3}-1}{4}\right).$$

Sinew.—At a given instant one steamer is 10 miles west of another. The first travels N.E. at the rate of 20 miles an hour, and the second N.W. at the rate of 16 miles an hour. Find how near they approach. (*Tutorial Dynamics.*)

Let A and B denote the positions of the steamers at the given instant when the first is 10 miles due west of the second. It is obvious that the tracks of the steamers will intersect at a point C equidistant from A and B, and that the angle ACB will be a right angle. We have therefore $AC = BC = \sqrt{50}$ miles. At any time after the given instant, let the first steamer be x miles from A. Then the second steamer will be $\frac{16}{20}x$ miles from B. Hence the first steamer will be $(x \sim \sqrt{50})$ miles from C, and the second steamer will be $(0{\cdot}8x \sim \sqrt{50})$ miles from the same point. The square of the distance between the steamers is given by $(x \sim \sqrt{50})^2 + (0{\cdot}8x \sim \sqrt{50})^2$.

If this expression for the square of the distance be represented by y^2 we have

$$y^2 = 1{\cdot}64x^2 - 3{\cdot}6\sqrt{50}x + 100.$$

Solving this quadratic equation for x we have

$$1{\cdot}64x = 1{\cdot}8\sqrt{50} \pm \sqrt{50\,(1{\cdot}8)^2 - 1{\cdot}64\,(100-y^2)}.$$

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Hence for real values of x we cannot have

$\{50(1{\cdot}8)^2 - 1{\cdot}64(100 - y^2)\}$ less than zero;

$\therefore$ $\{1{\cdot}64y^2 - (164 - 162)\}$ cannot be less than zero;

$\therefore$ $1{\cdot}64y^2$ cannot be less than 2;

$\therefore$ y^2 cannot be less than $\frac{50}{41}$.

The distance of nearest approach is therefore

$\sqrt{\frac{50}{41}}$ miles, or 1·104 miles.

P. W. B.—If a, b, c, be the sides of a triangle, and α, β, γ, the perpendiculars upon them from the opposite angles, show that

$$\frac{a^2}{\beta\gamma}+\frac{\beta^2}{\gamma\alpha}+\frac{\gamma^2}{\alpha\beta}=\frac{bc}{a^2}+\frac{ca}{b^2}+\frac{ab}{c^2}.$$

(Hamblin Smith's *Elementary Trigonometry.*)

Since the area of the triangle is equal to half the product of any side and the perpendicular from the opposite angle, we have

$$\text{Area of triangle}=\frac{a\alpha}{2}=\frac{b\beta}{2}=\frac{c\gamma}{2}.$$

$$\text{Hence } \frac{a}{\beta}=\frac{b}{\alpha} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$\frac{\beta}{\gamma}=\frac{c}{b} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$\frac{\gamma}{\alpha}=\frac{a}{c} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

Dividing (1) by (3) we have

$$\frac{a^2}{\beta\gamma}=\frac{bc}{a^2}.$$

Again, dividing (2) by (1), we have

$$\frac{\beta^2}{\gamma\alpha}=\frac{ca}{b^2}.$$

Also, dividing (3) by (2), we have

$$\frac{\gamma^2}{\alpha\beta}=\frac{ab}{c^2};$$

$$\therefore \quad \frac{a^2}{\beta\gamma}+\frac{\beta^2}{\gamma\alpha}+\frac{\gamma^2}{\alpha\beta}=\frac{bc}{a^2}+\frac{ca}{b^2}+\frac{ab}{c^2}.$$

Gunner.—If a particle be projected from one extremity of the axis major of an ellipse, the minor axis of which is vertical, so as to exactly shoot down a thin tube extending from the upper end of the minor axis to the other end of the axis major; show that, α being the angle of projection, and $\cos\beta$ the eccentricity of the ellipse,

$$\tan\alpha = 3\sin\beta.$$

(Walton's *Problems.*)

Taking the point of projection as origin, and the axis major as axis of x, the equation of the path of the particle referred to rectangular axes is

$$y=\tan\alpha\, x-\frac{gx^2}{2V^2\cos^2\alpha} \quad . \quad . \quad . \quad (1)$$

where V is the velocity of projection.

To satisfy the conditions of the question, the curve (1) must pass through (a, b), the upper end of the minor axis; also the tangent to (1) at the point (a, b) must coincide with the axis of the tube—*i.e.* must make the angle $\tan^{-1}\left(\frac{-b}{a}\right)$ with the axis of x.

Hence we must have

$$b=a\tan\alpha-\frac{ga^2}{2V^2\cos^2\alpha},$$

$$\text{that is } \frac{g}{V^2\cos^2\alpha}=\frac{2(a\tan\alpha-b)}{a^2} \quad . \quad . \quad . \quad (2)$$

Also, on writing a for x in the right hand side of the equation $\frac{dy}{dx}=\tan\alpha-\frac{gx}{V^2\cos^2\alpha}$ the resulting expression must be equal to $-\frac{b}{a}$, *i.e.* we must have

$$\tan\alpha-\frac{g\alpha}{V^2\cos^2\alpha}=-\frac{b}{a} \quad . \quad . \quad . \quad (3)$$

Writing in (3) the value of $\frac{g}{V^2\cos^2\alpha}$ obtained in (2), we have $\tan\alpha-\frac{2(a\tan\alpha-b)}{a^2}\cdot a=-\frac{b}{a}$.

$$\therefore \quad \tan\alpha-\frac{2}{a}(a\tan\alpha-b)=-\frac{b}{a};$$

$$\therefore \quad \tan\alpha=3\frac{b}{a} \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Now, by the question, the eccentricity of the ellipse is expressed by $\cos\beta$.

$$\therefore \quad \cos^2\beta=\frac{a^2-b^2}{a^2};$$

$$\therefore \quad \sin^2\beta=1-\frac{a^2-b^2}{a^2}=\frac{b^2}{a^2};$$

$$\therefore \quad \frac{b}{a}=\sin\beta.$$

Hence equation (4) may be written

$$\tan\alpha=3\sin\beta.$$

Kaliya.—If $y^2=x^2+x+1$, show that

$$\frac{d}{dx}\left(\frac{x+y}{x-y}\right)+\frac{(x+2)(2x^2+x+1+2xy)}{(x^2+x+1)(x+1)^2}\cdot y=0.$$

(B.Sc. London, 1904.)

$$\frac{d}{dx}\left(\frac{x+y}{x-y}\right)=\frac{(x-y)\left(1+\frac{dy}{dx}\right)-(x+y)\left(1-\frac{dy}{dx}\right)}{(x-y)^2}$$

$$=\frac{2x\frac{dy}{dx}-2y}{(x-y)^2}.$$

But $2y\frac{dy}{dx}=2x+1$. $\therefore$ $\frac{dy}{dx}=\frac{2x+1}{2y}$.

Hence

$$\frac{d}{dx}\left(\frac{x+y}{x-y}\right)=\frac{2x\frac{2x+1}{2y}-2y}{(x-y)^2}=\frac{2x(2x+1)-4y^2}{2y(x-y)^2}$$

$$=\frac{4x^2+2x-4(x^2+x+1)}{2y(x-y)^2}=\frac{-2x-4}{2y(x-y)^2}$$

$$=\frac{-(x+2)}{y(x-y)^2}=\frac{-(x+2)}{y^3(x-y)^2}\cdot y$$

$$=\frac{-(x+2)\cdot(x+y)^2}{(x^2+x+1)(x-y)^2(x+y)^2}\cdot y=\frac{-(x+2)(x+y)^2}{(x^2+x+1)(x^2-y^2)^2}\cdot y$$

$$=\frac{-(x+2)(x^2+2xy+y^2)}{(x^2+x+1)(-x-1)^2}\cdot y$$

$$=\frac{-(x+2)(2x^2+x+1+2xy)}{(x^2+x+1)(x+1)^2}\cdot y;$$

$$\therefore \quad \frac{d}{dx}\left(\frac{x+y}{x-y}\right)+\frac{(x+2)(2x^2+x+1+2xy)}{(x^2+x+1)(x+1)^2}\cdot y=0.$$

THE President of the Board of Education, the Marquess of Londonderry, K.G., has appointed Mr. E. G. A. Holmes, one of His Majesty's Inspectors of Schools and Divisional Inspector, to be Chief Inspector of Elementary Schools. Mr. Edmund Gore Alexander Holmes was born on July 17, 1850. He was educated at Merchant Taylor's School and at St. John's College, Oxford, of which he was a Scholar, and was placed in the First Class both in Honours Moderations in 1871 and in "Greats" in 1873. He was appointed an Inspector of Schools in April 1875, and was successively in charge of the Huddersfield, Ashford (Kent), and Oxfordshire districts. He was promoted on 1st October 1903 to be Divisional Inspector for the Northern Division, and appointed to inspect Training Colleges in the North of England.

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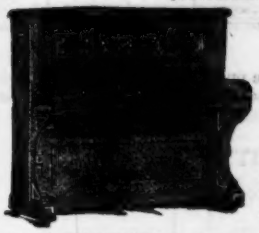

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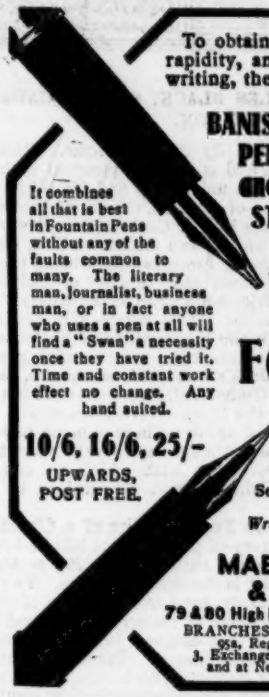

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THE EDITOR'S TABLE

ADAM AND CHARLES BLACK, SOHO SQUARE, LONDON.

From Fag to Monitor. By Andrew Home. This is a reissue of an old favourite, and is chiefly concerned with Jack Graham's own account of his upbringing and his school days. The only survivor—a babe—of a wreck, this bit of flotsam was rescued from the workhouse by Dr. Graham, a widower, who adopted Jack and brought him up as a brother to Will, his only child. The two boys, or foster brothers—Jack being the elder—naturally become great chums; and the story of their school days, their vicissitudes of friendship when Jack realises his true position, their life at a public school where Will becomes a greater favourite than Jack, the blackmailing of Mattocks—the fisherman smuggler—who retained the papers which gave the clue to Jack's birthright, Jack's wonderful adventures, and the excellent character of Dr. Graham, all form material for a thrilling story which will win the heart of every schoolboy. The "fagging" and "ragging" of which we hear so much nowadays are vividly portrayed; and although apparently an inherent part of public school life, is one with which we can little sympathise. There are eight coloured illustrations by John Williamson.

Exiled from School; or, For the Sake of a Chum. By Andrew Home. Another story of public school life, and following much the same lines as the author's *From Fag to Monitor*, although the underlying plot is distinctly different. Two boys, George Kirby and Sidney Hardy, meet at the station of a town containing two grammar schools—"Homer House" and "The Grammar School." Sidney is consigned to "The Grammar School" and George to "Homer House." Enter Jim Patterson—a pupil of the Grammar School—who immediately forms a great friendship for George, who is unfortunately bound for "Homer House." Now Sidney was determined not to go to school, as he held a secret of his guardian, who was a fraudulent adventurer. Jim Patterson, the irrepressible, quickly grasps the situation, and persuades George to personate Sidney, who smuggles himself on board a barque bound for Norway. The plot now follows the adventures of Sid. at sea and George at the Grammar School, and is worked up by Mr. Home into a very engrossing story. Mr. J. Williamson is responsible for the eight coloured illustrations.

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II. **"Old Dick Grey and Aunt Kate's Way."** These two stories form another book in which no word contains more than four letters.

III. **"Maud's Doll and Her Walk"** are stories nicely told.

IV. **"The Holiday Time,"** with words of five letters, cannot be recommended for use in schools. "Kids are here—he meant small girls." "What a lark!—he meant what fun." "You muffs, you dolts, you oafs." These sentences need no comment.

R. CULLEY, LONDON.

The Ludgate Reciter, for Guild, School, and Home, with a Selection for Young Children: Recitations by G. R. Sims, F. H. Gassaway, H. A. Forde, Clement Scott, Sir A. Conan Doyle, Will Carleton, J. G. Whittier, and many others. This forms a useful collection for the purposes indicated in the title, though in a considerable number of instances the literary value of the selections is of the slightest.

FOR THE LITTLE ONES.

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Bo-Peep, a Treasury for the Little Ones.
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CHRISTMAS without Christmas books would be flat, stale, and unprofitable, and this is so well recognised that to-day there is no member of the civilised world between the ages of, say, three and one hundred who is forgotten in the annual output of these good things. The above collection will appeal to a wide circle of readers with ages bordering on the lower limit, and will be found eminently suitable.

The stories and verses are by well-known writers for children; the illustrations, coloured in many instances, and always excellently done, are found on nearly every page; the type is big and clear; and the binding in picture boards or cloth just the thing for children's books. The first three are a little more advanced than the others, and would make glad the heart of any boy or girl between eight and eleven years of age, while the remainder will give equal or greater delight to the tiny tots. Bo-Peep is also published in three separate volumes, of which Tiny Tales forms one.

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Cast Away among the Filipinos. By William Seatter. Illustrated by W. B. Wollen, R.I. This is one of the stories which have originated and which still illustrate the saying that truth is stranger than fiction. The hero of the tale—a modest hero, though he tells it in the first person—is a native of the Orkney Islands, a sailor, who was cast away among the Philippine Islands during the recent war. The story of his adventures and his sufferings is told in a plain and unadorned manner, but the bare enumeration of his experiences make up a sum which would fit out half-a-dozen books of fictitious adventure. The reader will strive to finish the book at one sitting, and will end by wishing to congratulate the sailor lad on his escape, and also on the straightforward manner in which he has given us the story of his unhappy experiences.

Her First Term; or, The Ghost of Marcot Grange. By Olivia Fowell. Coloured illustrations. Ghosts are in season about Christmas, and the mere title of this book will secure it many readers. Stories of school life are also of perennial interest—hence another claim to popularity by this book. It appeals chiefly to girls, and can be recommended to persons who are looking for a suitable present to such at this season.

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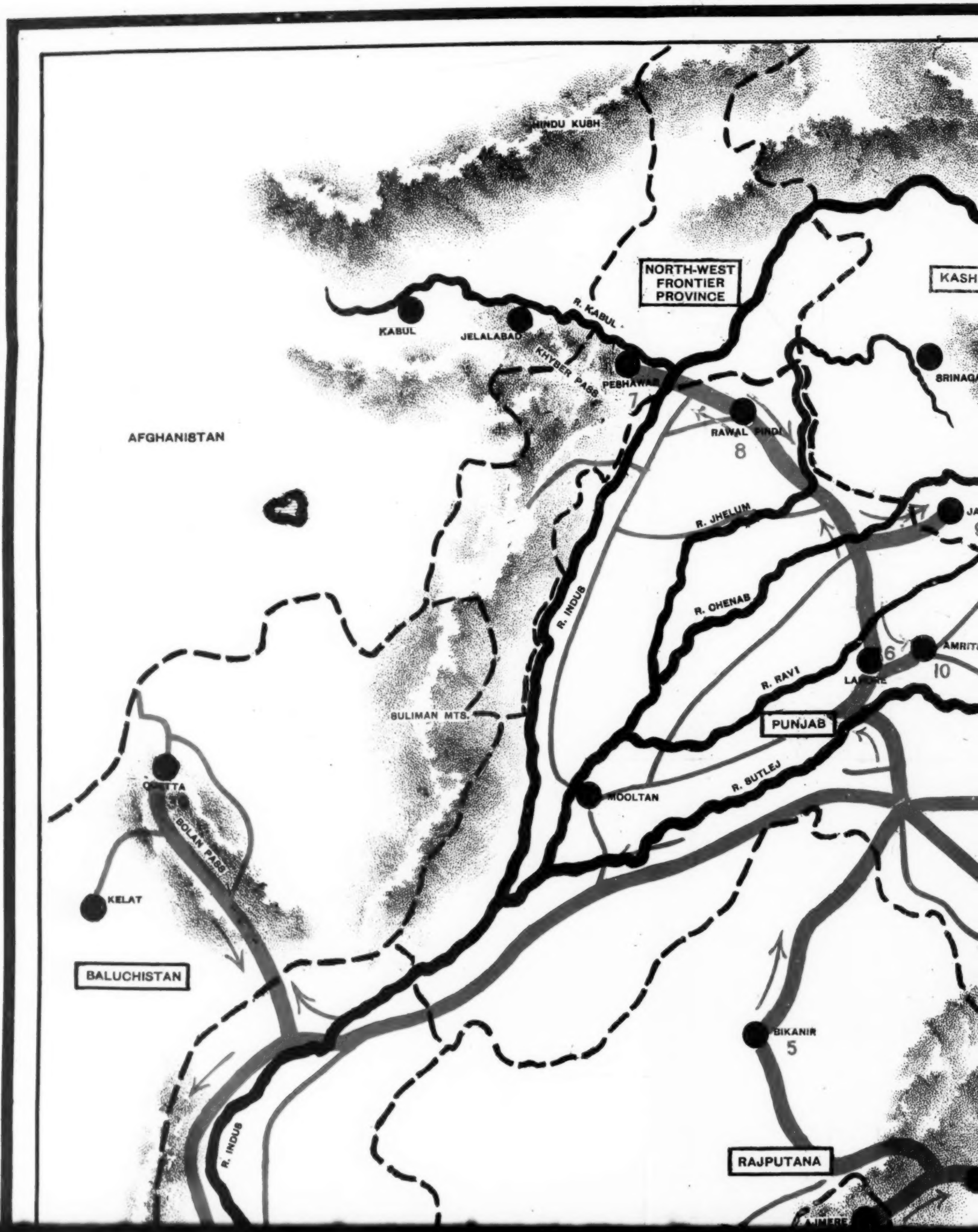
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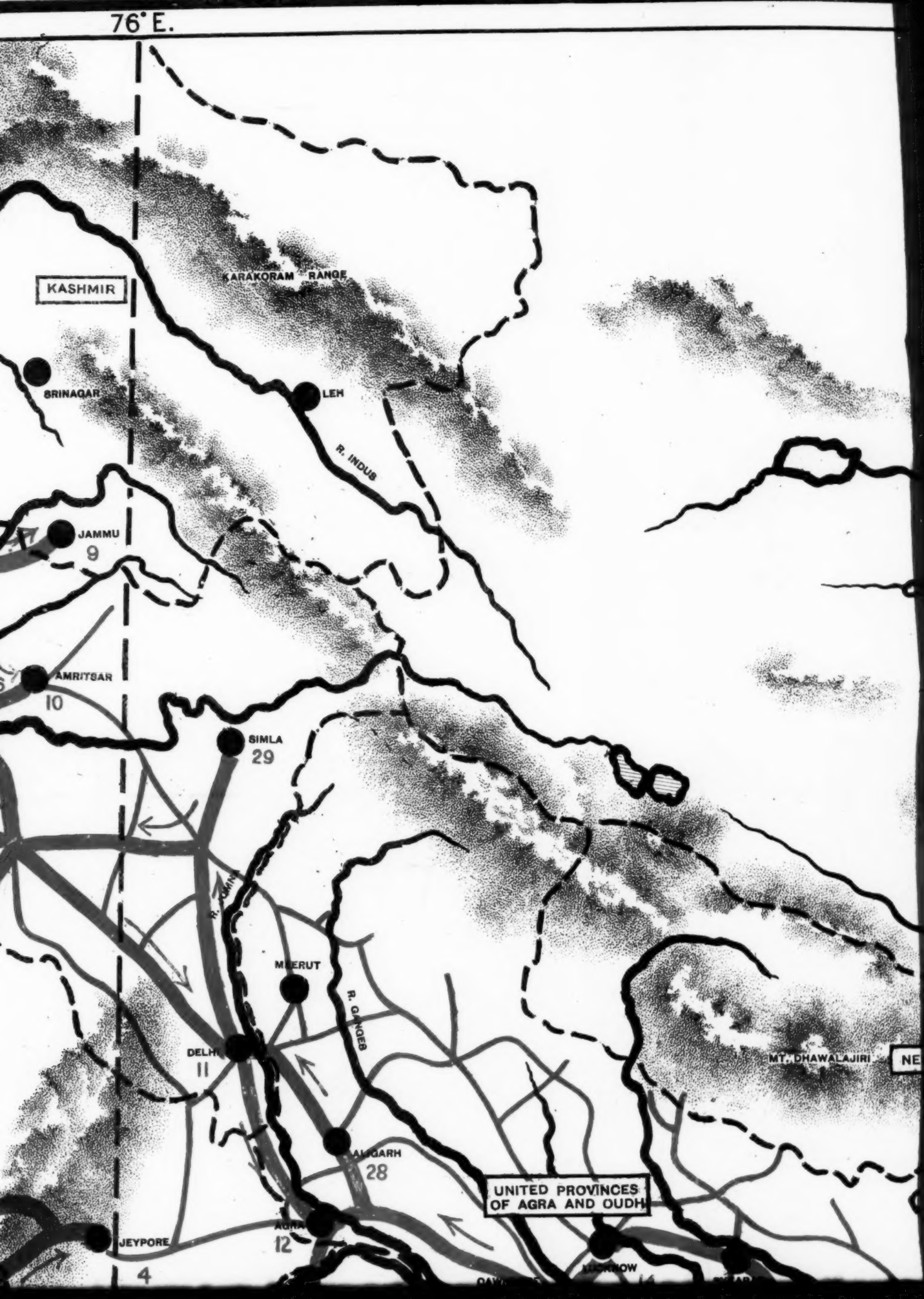

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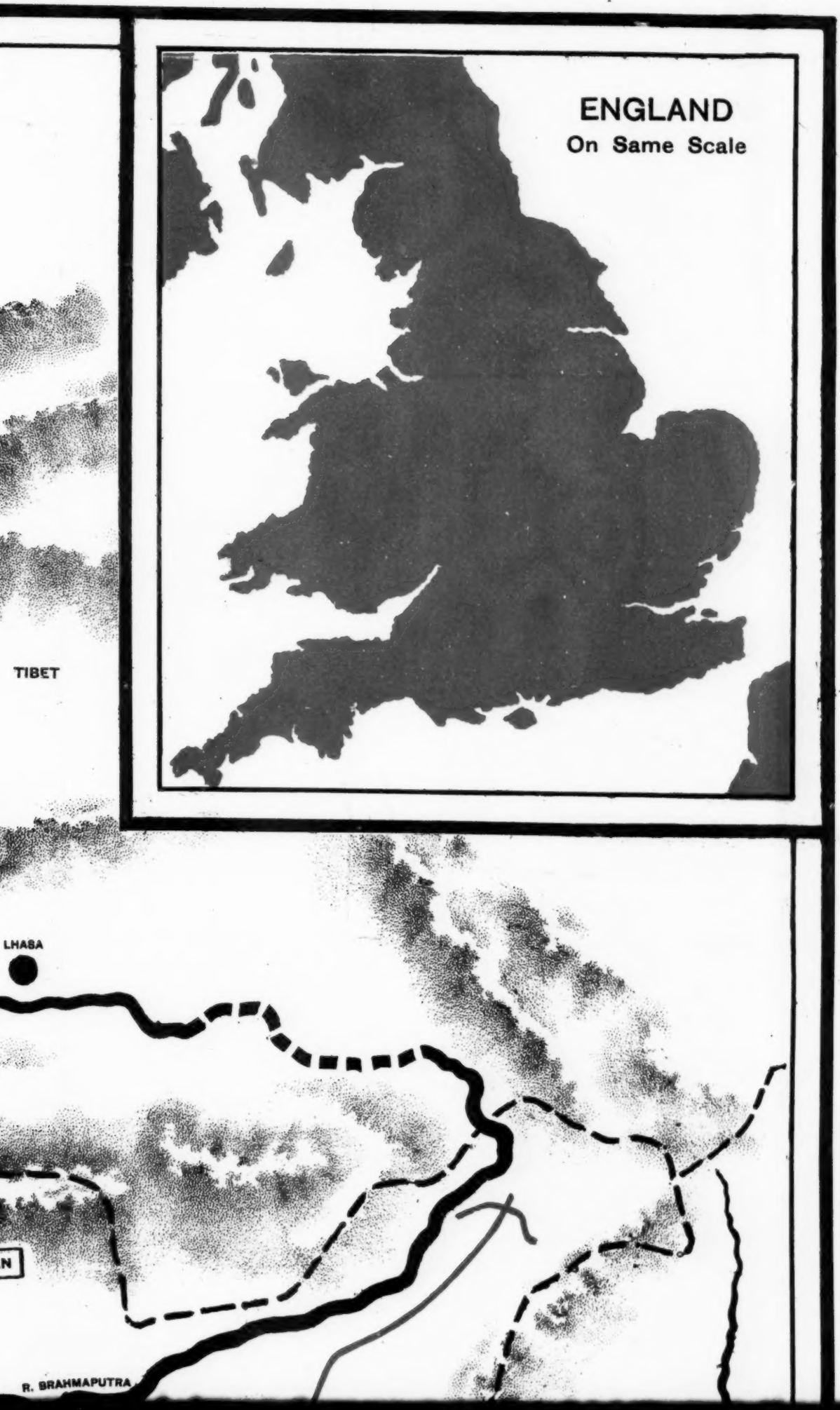
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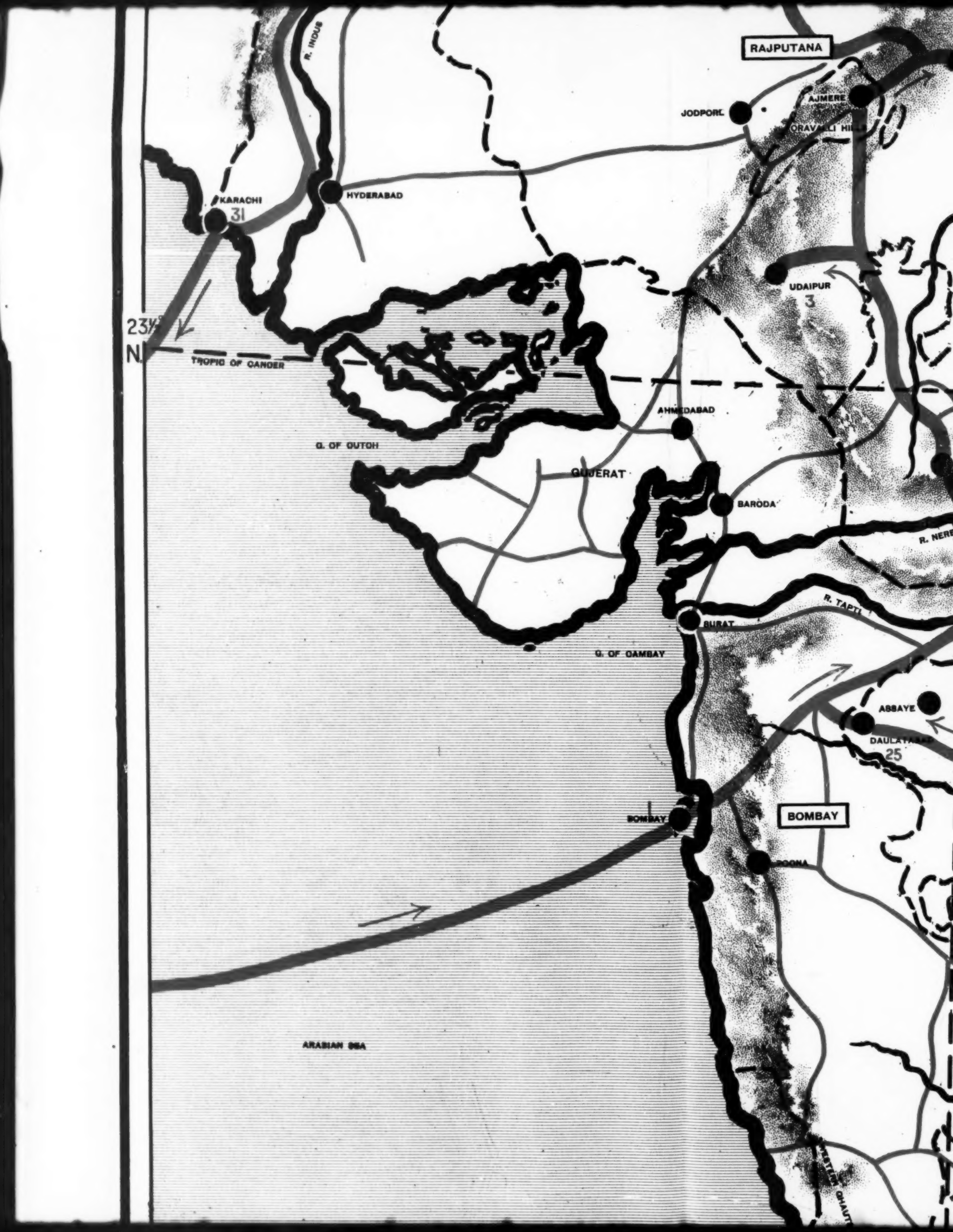
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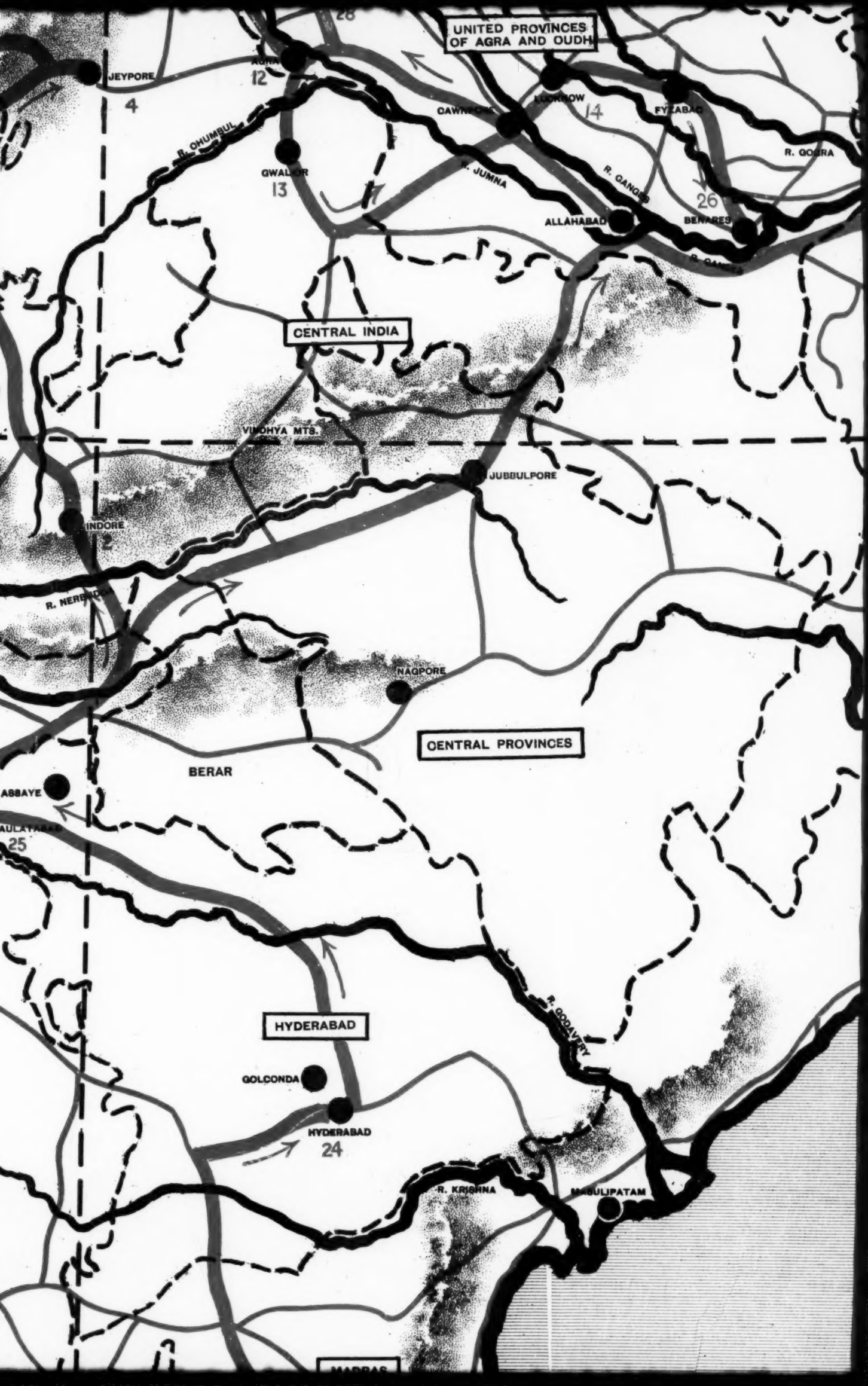
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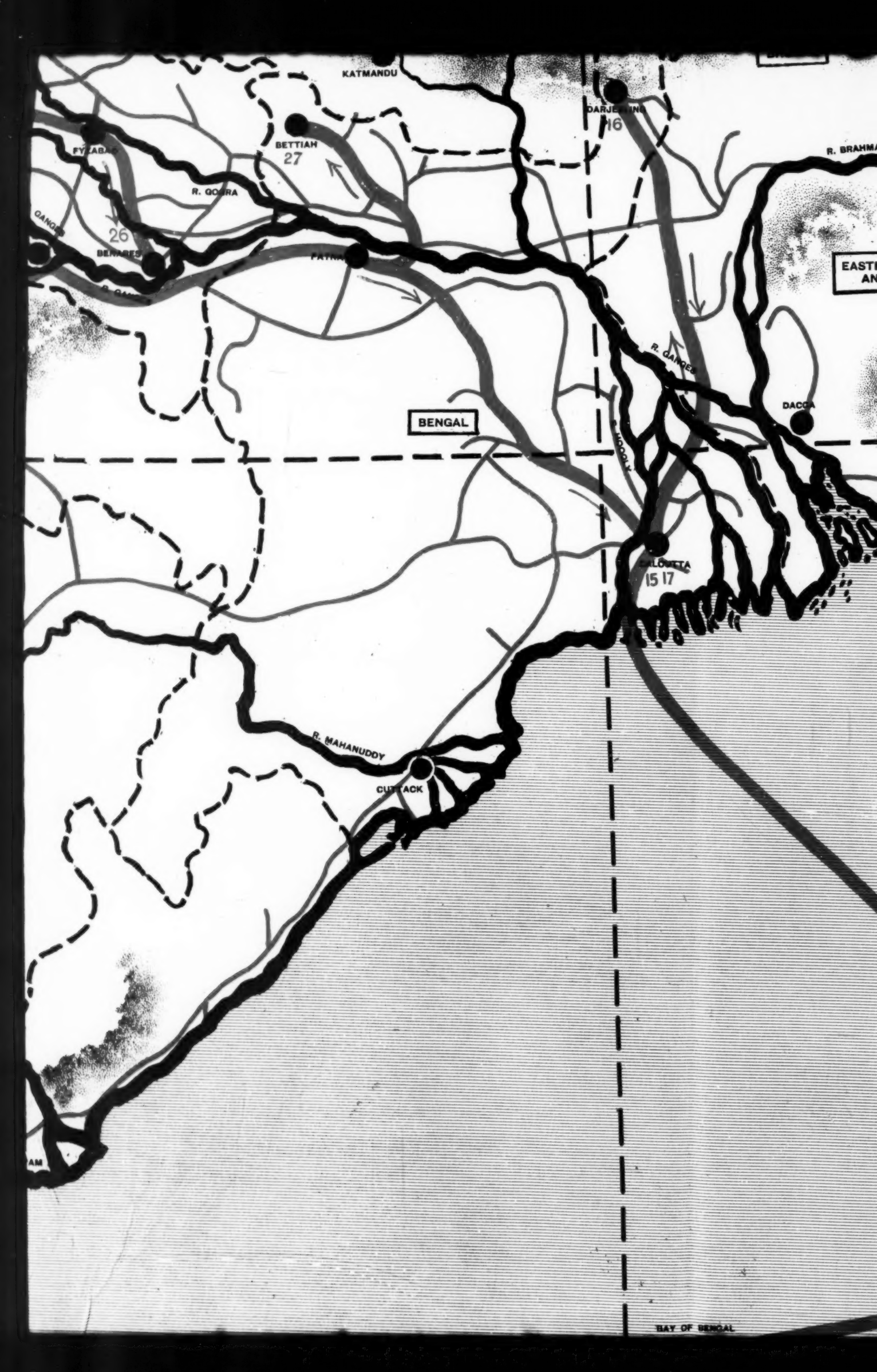
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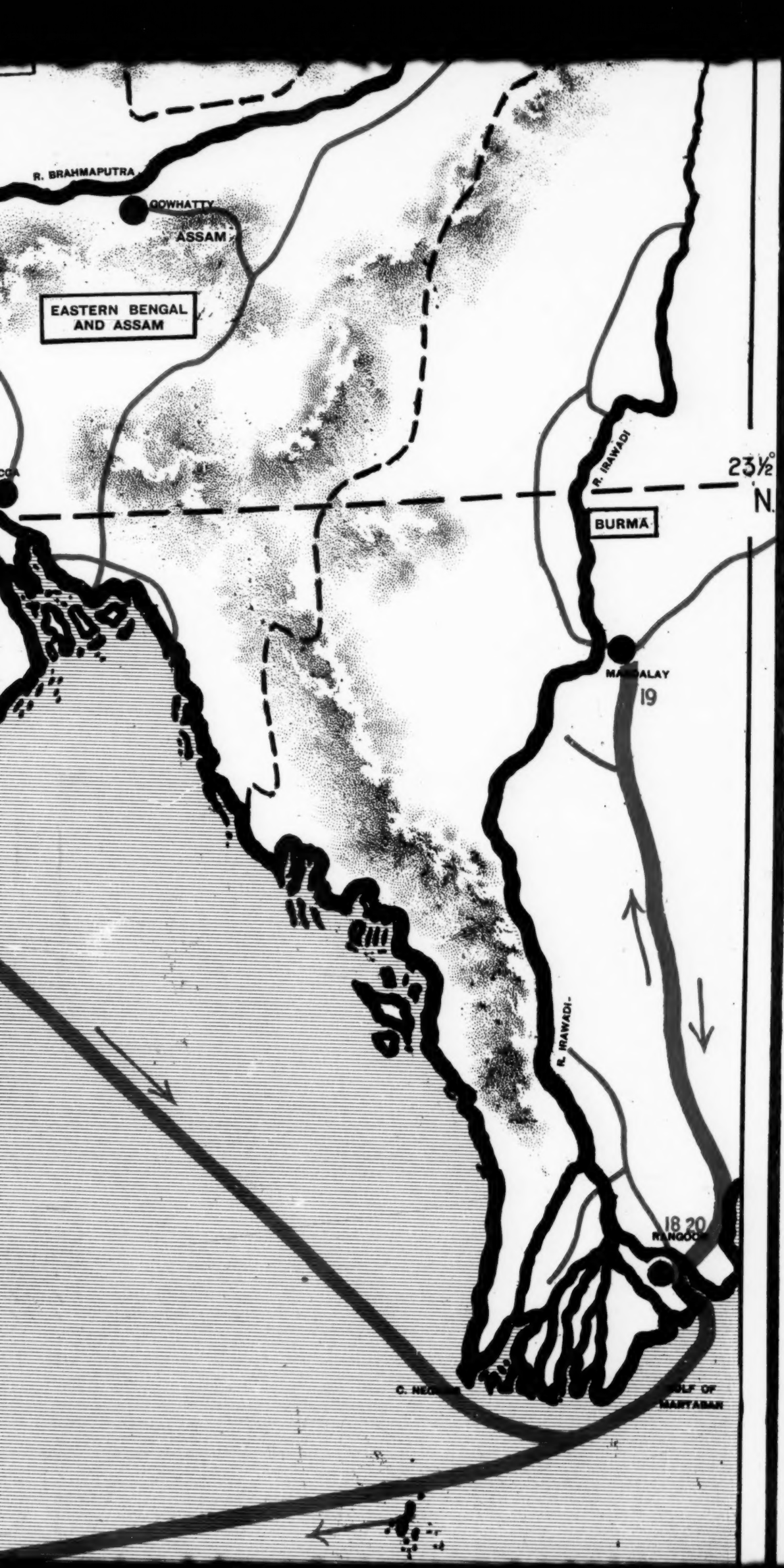
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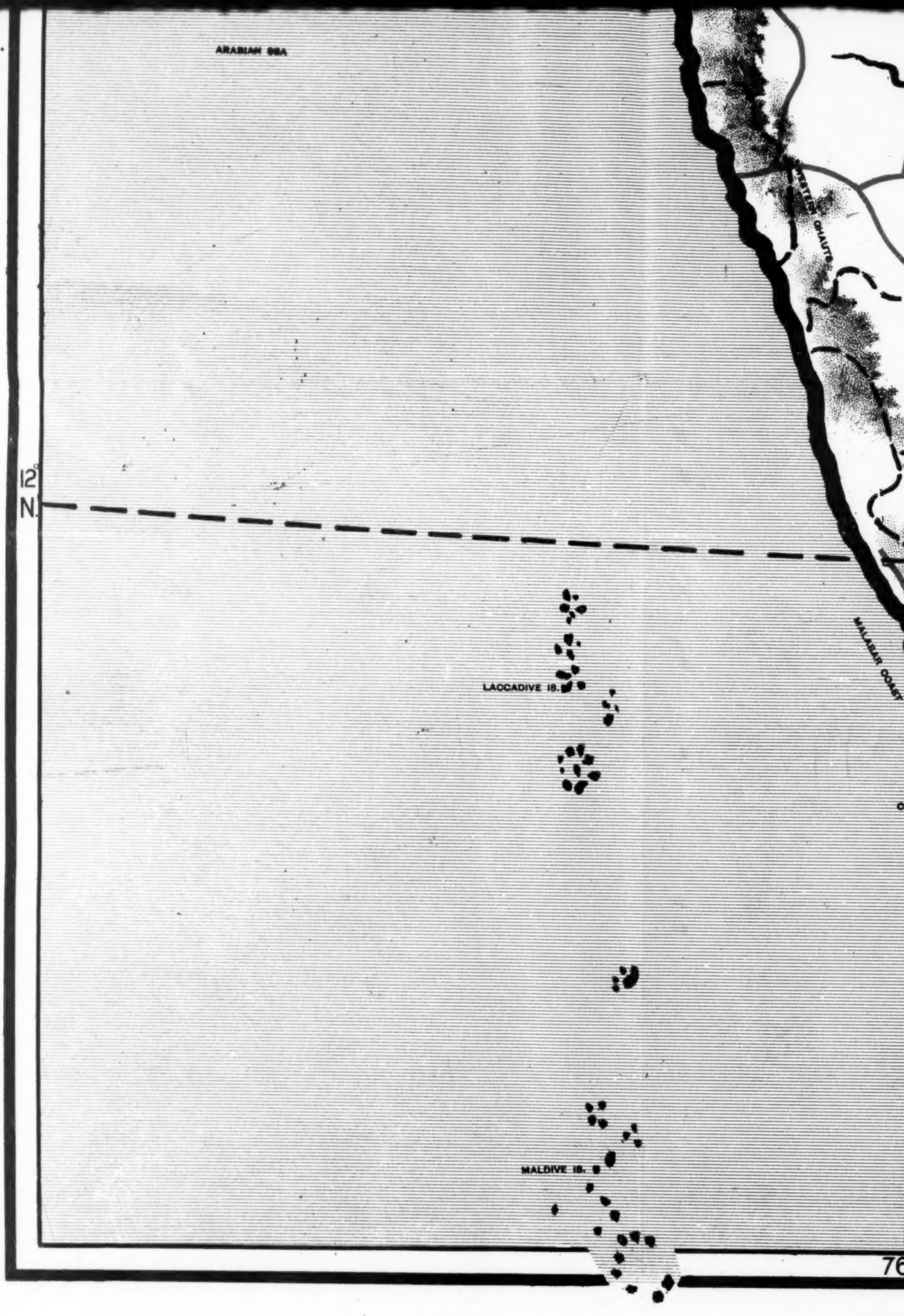

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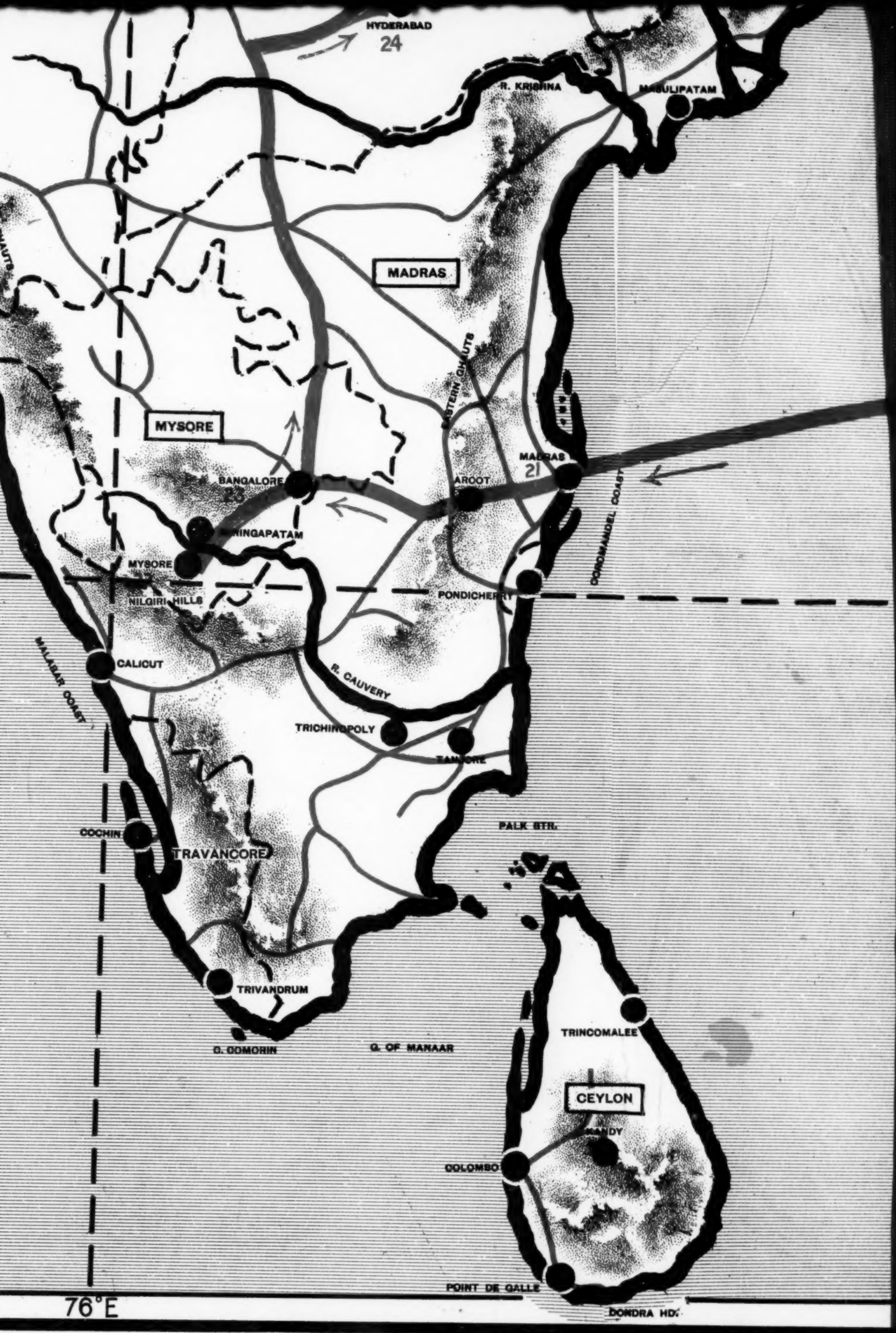
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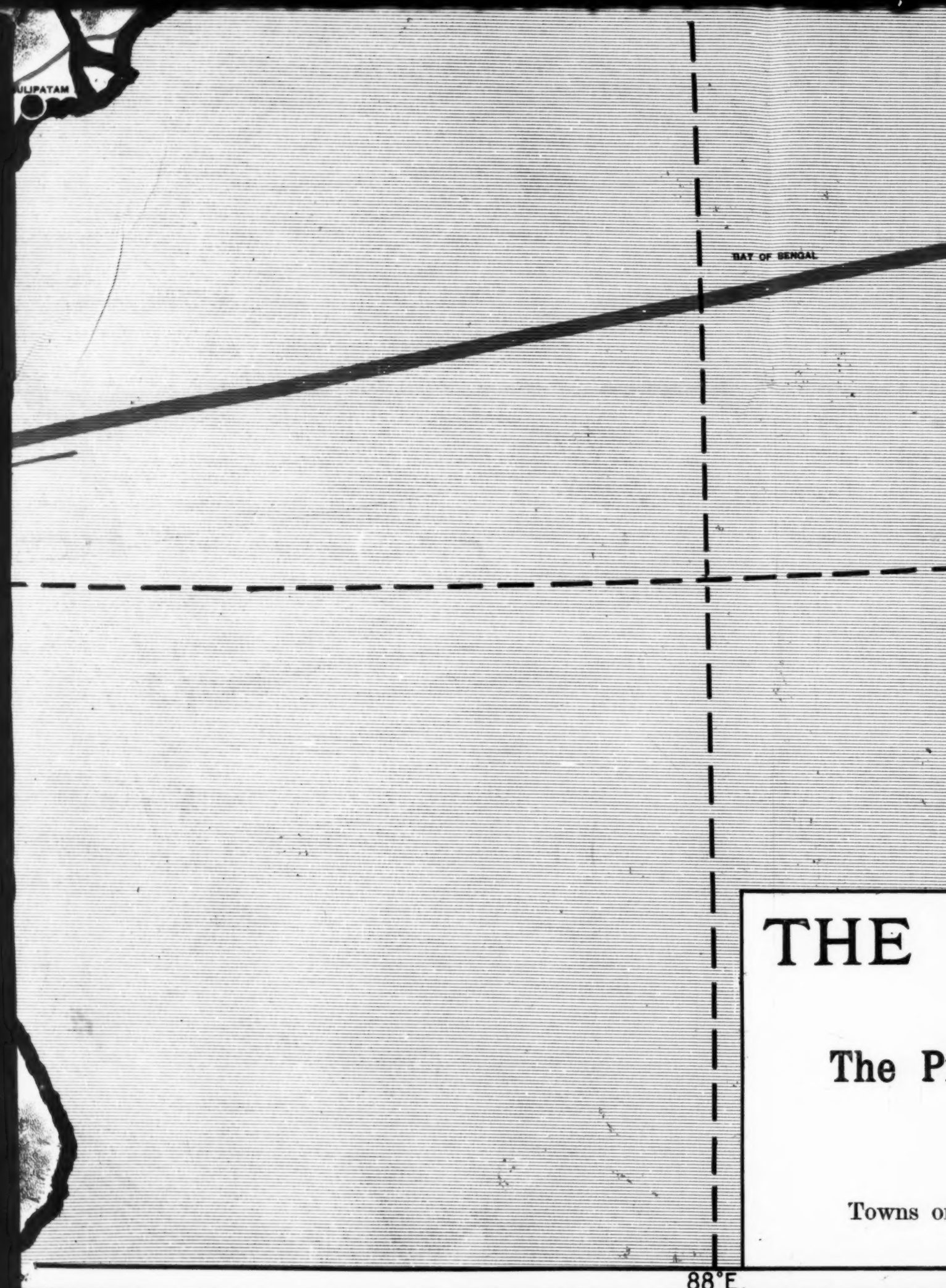

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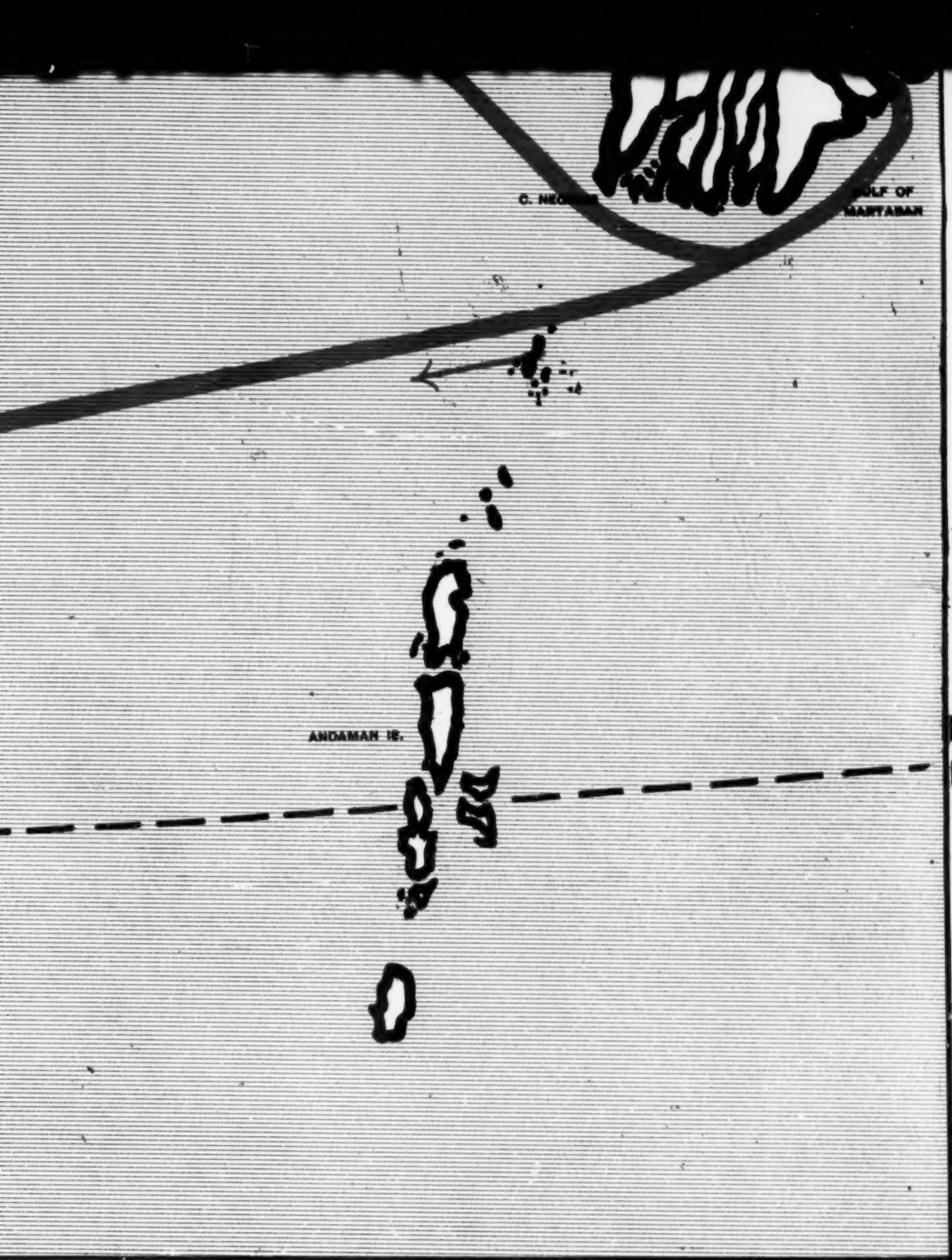

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